Faster...Faster...Faster...

1 Clocked at speeds over 60mph, the cheetah is the fastest land animal. This "big cat" hunts mainly gazelle, but the average chase lasts only about 20 seconds.

2 In early September 1998, *PC World* Magazine ranks the Micron Millennia the #1 Power Desktop on the market calling it "the fastest of all" systems tested.

INTRODUCING THE FULLY LOADED MICRON 450MHz MILLENNIA

MICRON GOES TO WORK

Raytheon Data Systems
Defense Contractor

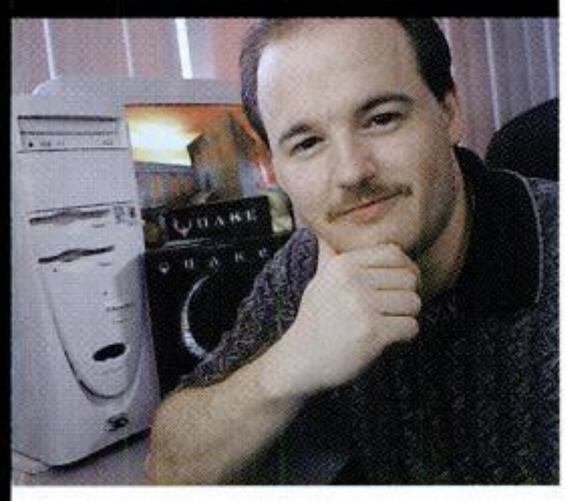
Micron Systems:
Over 100,000 deployed Micron desktops, notebooks & servers

Favorite Feature:
Price/power ratio

Purpose:
Help maintain US security and freedom

For The Whole Story: www.micronpc.com

Tim Willits
Lead Map Designer, id Software
Creators of Quake & Quake II



Micron Systems:
Micron Millennia 400 desktops

Favorite Feature:
400MHz - Of course

Purpose:
Test mind-bending levels of Quake II and help create one of the coolest games ever

For The Whole Story:
www.micronpc.com

MICRON RANKED #1 DESKTOP CUSTOMER SATISFACTION‡‡

intel inside
pentium® II

Featuring Intel's Fastest Processor Ever

Just named #1 Power Desktop by the editors of *PC World* Magazine (Millennia 400 DVD • September '98), Micron's Millennia desktop product line continues a long tradition of industry-leading, award-winning performance. Perhaps that's why some of the most prominent power users around rely on Micron. No matter how strenuous your demands, no matter how colossal the task, we invite you to put a Millennia™ desktop to the test. You'll be hard-pressed to find a Pentium® II processor based system as powerful and affordable as the Micron Millennia. And Micron's revolutionary new MPower℠ purchase program makes Millennia ownership even easier, offering qualified users no interest◊◊ or payments for six months as well as PowerXchange℠ trade-in options on your current PC towards a new Millennia desktop.

MICRON'S EXCLUSIVE CONSUMER NO PAYMENTS NO INTEREST 6 MONTH SAME AS CASH OFFER

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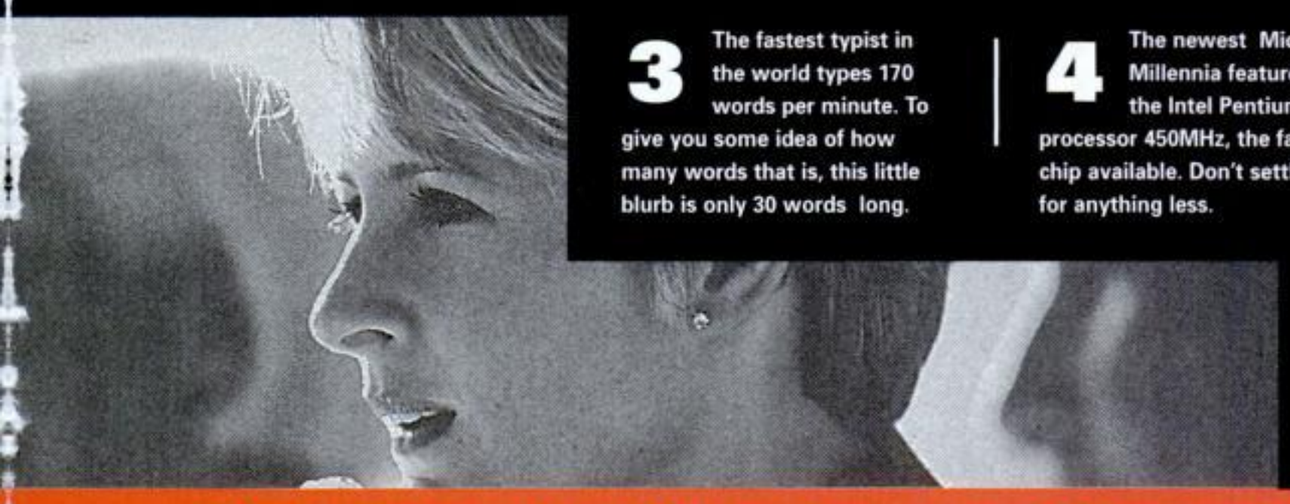

3 The fastest typist in the world types 170 words per minute. To give you some idea of how many words that is, this little blurb is only 30 words long.

4 The newest Micron Millennia features the Intel Pentium II processor 450MHz, the fastest chip available. Don't settle for anything less.

THERE IS NO KNOWLEDGE THAT IS NOT POWER.

— RALPH WALDO EMERSON

10
VOL. M SEC. 01
98.10

How important is a 15% performance difference? Think of it as 1 hour and 12 minutes in an 8-hour day.

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Model Name	Millennia C300	Millennia 350	Millennia 400	New! Millennia 450	New! Millennia 450 MAX
Processor	Intel® Celeron™ processor 300MHz	Intel Pentium® II processor 350MHz	Intel Pentium II processor 400MHz	Intel Pentium II processor 450MHz	Intel Pentium II processor 450MHz
Cache	128KB internal cache	512KB internal cache	512KB internal cache	512KB internal cache	512KB internal cache
RAM	32MB SDRAM	64MB 100MHz SDRAM	64MB 100MHz SDRAM	64MB 100MHz SDRAM	128MB 100MHz SDRAM
Hard Drive	4.3GB Ultra ATA hard drive	8.4GB Ultra ATA hard drive	10GB Ultra ATA hard drive	10GB Ultra ATA hard drive	14.4GB 7200 RPM Ultra ATA hard drive
Monitor	15" Micron 500Vx monitor (13.8" display)	17" Micron 700Vx monitor (15.9" display)	17" Micron 700Vx monitor (15.9" display)	17" Micron 700Vx monitor (15.9" display)	19" Micron 900Lx monitor (18" display)
DVD/CD-ROM	32X max speed CD-ROM drive	32X max speed CD-ROM drive	32X max speed CD-ROM drive	32X max speed CD-ROM drive	DVD-ROM drive and decoder card***
Graphics	nVidia Riva 128, 4MB SGRAM 3D AGP graphics	nVidia Riva 128, 4MB SGRAM 3D AGP graphics	nVidia Riva 128, 4MB SGRAM 3D AGP graphics	nVidia Riva 128, 4MB SGRAM 3D AGP graphics	Real 3D Starfighter i740, 8MB AGP graphics
Sound System	PCI 64-voice Wavetable sound	PCI 64-voice Wavetable sound	PCI 64-voice Wavetable sound	PCI 64-voice Wavetable sound	64-voice Wavetable 3D stereo sound
Warranty	5-year/3-year Micron Power℠ limited warranty	5-year/3-year Micron Power limited warranty	5-year/3-year Micron Power limited warranty	5-year/3-year Micron Power limited warranty	5-year/3-year Micron Power limited warranty
Software Included	Microsoft® Windows® 98 Microsoft Office 97 Small Business Edition	Microsoft Windows 98 Microsoft Office 97 Small Business Edition	Microsoft Windows 98 Microsoft Office 97 Small Business Edition	Microsoft Windows 98 Microsoft Office 97 Small Business Edition	Microsoft Windows 98 Microsoft Office 97 Small Business Edition
Also Includes:	New MicroTower™ case Advent AV009 stereo speakers 3Com/U.S. Robotics 56K WinModem** 104-key enhanced keyboard Microsoft IntelliMouse® 3.5" floppy drive	New MicroTower case Advent AV009 stereo speakers 3Com/U.S. Robotics 56K WinModem** 104-key enhanced keyboard Microsoft IntelliMouse 3.5" floppy drive	New MicroTower case Advent AV009 stereo speakers 3Com/U.S. Robotics 56K WinModem** 104-key enhanced keyboard Microsoft IntelliMouse 3.5" floppy drive	New MicroTower case Advent AV009 stereo speakers 3Com/U.S. Robotics 56K WinModem** 104-key enhanced keyboard Microsoft IntelliMouse 3.5" floppy drive	Micron MiniTower case Advent AV390PL-70 watt 3-piece sound system Advent subwoofer 3Com/U.S. Robotics 56K WinModem** 104-key enhanced keyboard Microsoft IntelliMouse 3.5" floppy drive
Price	$1,199 $42/mo. TechRefresh Bus. Lease, 36 mos.**	$1,649 $58/mo. TechRefresh Bus. Lease, 36 mos.**	$1,849 $65/mo. TechRefresh Bus. Lease, 36 mos.**	$1,899 $66/mo. TechRefresh Bus. Lease, 36 mos.**	$3,099 $108/mo. TechRefresh Bus. Lease, 36 mos.**
Upgrade to:	6.4GB Ultra ATA hard drive 17" Micron 700Vx monitor (15.9" display) 100MB Iomega Zip drive	10GB Ultra ATA hard drive 100MB Iomega Zip drive Microsoft Natural Keyboard Elite	19" Micron 900Lx (18" display) 100MB Iomega Zip drive Advent subwoofer	19" Micron 900Lx (18" display) 100MB Iomega Zip drive Advent subwoofer	100MB Iomega Zip drive 256MB 100MHz SDRAM
Price	$1,497 $52/mo. TechRefresh Bus. Lease, 36 mos.**	$1,833 $64/mo. TechRefresh Bus. Lease, 36 mos.**	$2,232 $78/mo. TechRefresh Bus. Lease, 36 mos.**	$2,282 $80/mo. TechRefresh Bus. Lease, 36 mos.**	$3,488 $121/mo. TechRefresh Bus. Lease, 36 mos.**

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AMD Talks K7, K8, and Beyond

Sound Blaster **Live** Explodes

11 Flat-Panel Monitors Tested

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3Dfx's **Banshee** 2D/3D videocard benchmarks head-to-head with nVidia's **TNT** in our exclusive **preview**

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The new **450MHz P-II** monolith from Gateway comes correct with stock **DVD** and **CD-R/RW** drives

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A pair of **2x8 CD-R drives** from Sony and Mitsumi earn an "11" verdict... if you add the scores **together**

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Flat-panel displays are the way you'll see your PC in the next millennium, so **tune in now** with our hot roundup

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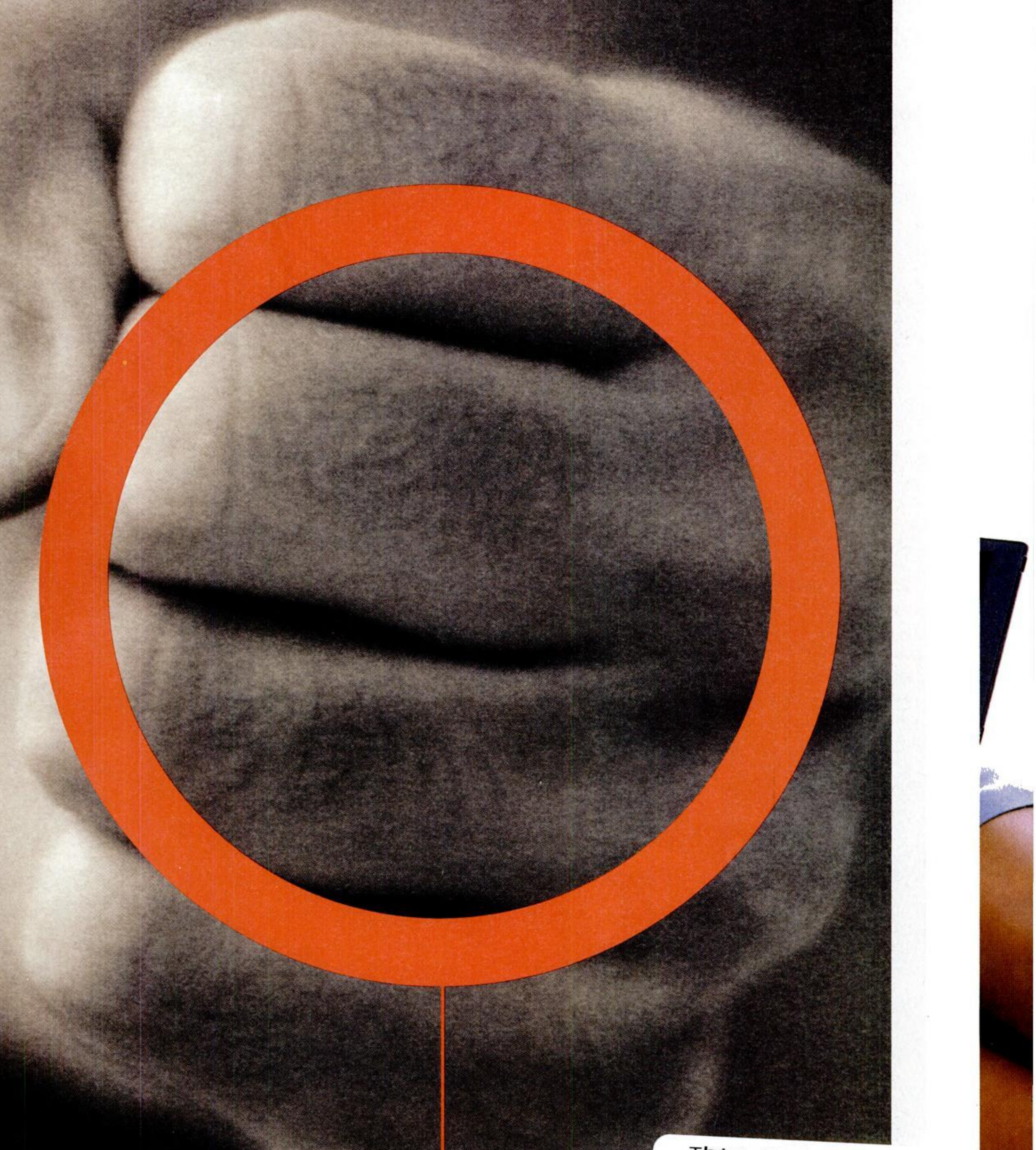

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THEY SPEND YOUR YEARLY BUDGET ON OFFICE PARTIES.
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MIND-BLOWING 128-BIT

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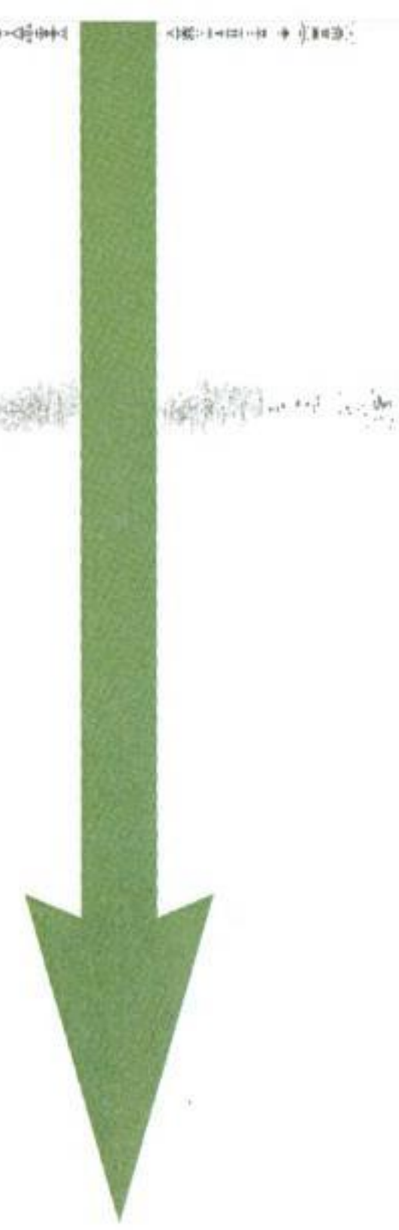

INTRODUCING THE RIVA TNT 3D PROCESSOR.

Hold onto your armrests...you're not going to believe your eyes. The new RIVA TNT graphics processor delivers the most stunning, realistic graphics ever seen on a personal computer screen.

The RIVA TNT's 32-bit color TwiN Texel pipeline with support for 16 Megabytes of frame buffer dares 3D applications to run at an unheard of 1600x1200 resolution. RIVA TNT also delivers explosive 2D for your business applications, like Photoshop.

The RIVA TNT is the first 3D processor to provide hardware support for Microsoft's new DX6 API, as well as full OpenGL support for professional applications on the Windows platform of your choice. And it's available only from the best graphics card suppliers in the world such as Diamond, STB, Creative Labs and Elsa.

Whether you are running one of the many new graphics-rich business applications, or playing the hottest new games, the RIVA TNT will blow you away. But don't just take our word for it. Head to our website at www.nvidia.com and we'll link you to those who have experienced the RIVA TNT firsthand. Then brace yourself; 'cuz this baby will blow the 3D market sky high.

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screams
and *chills* of
your favorite
games

and multiply by two.

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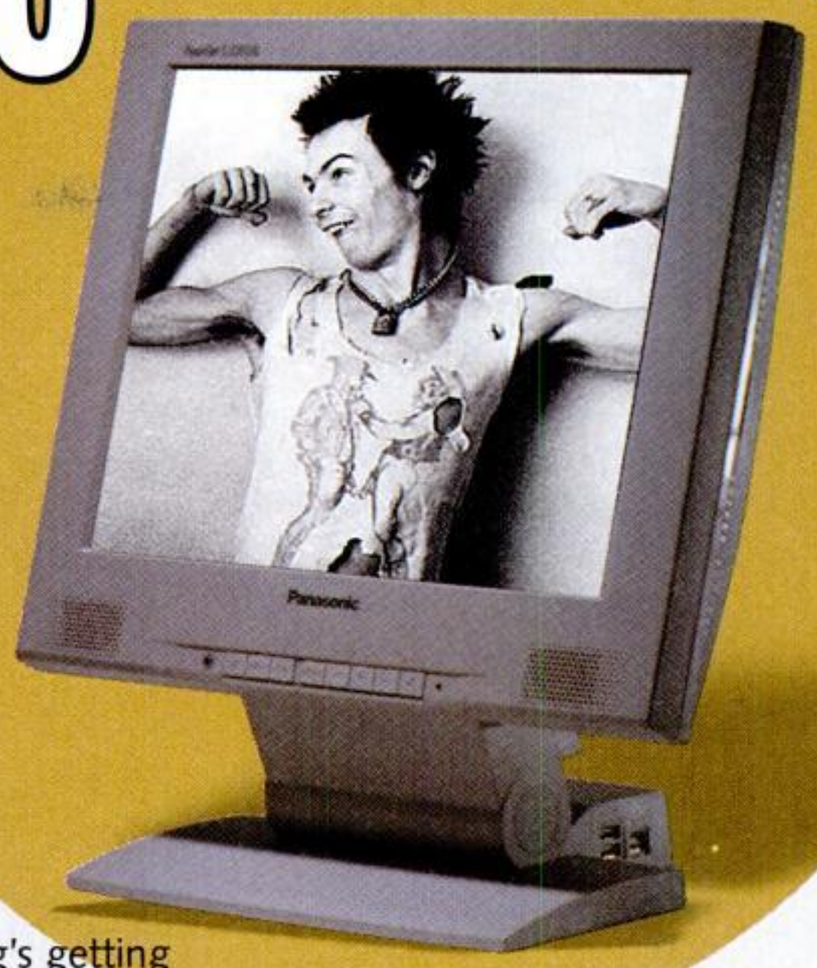
OCTOBER 1998



70 Thin Is In ▶

Flat-panel monitors are thin and oh-so-sexy—but only a few are good enough to challenge desktop displays. Learn how to spot flaws, and choose from 11 contenders.

◀66 The Skinny On Technology

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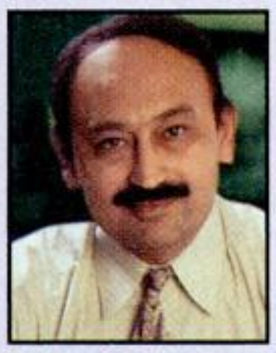
▼44 Interrogation: AMD's Atiq Raza

Get the scoop about AMD's newest chips: the K6-3 and the K7, and find out why AMD's CTO, Atiq Raza, still hates Intel.



57 No-Compromise Notebooks ▶

Today's mobile supermodels might be svelte, but they pack all the features of desktop systems. Five cutting-edge notebooks are reviewed and rated.

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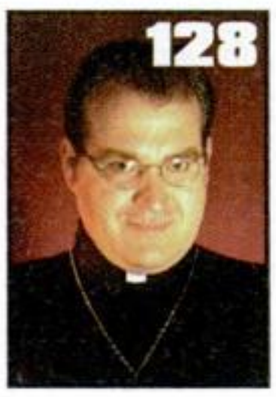

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News you need to win the tech race.

▶ It's worthless as a penny, but copper will fundamentally shift how we compute in the foreseeable future. Inside Sources has the scoop on what you need to know.

▶ And... With sales expected to hit 800,000 within a year, can the cute and clear iMac save Apple computer from itself?

▶ And... In the Spin Cycle we look at: Iomega buys a major competitor, Intel's new Celeron and P-II models, specs leaked on 3Com's next Palm PDA, and much more.

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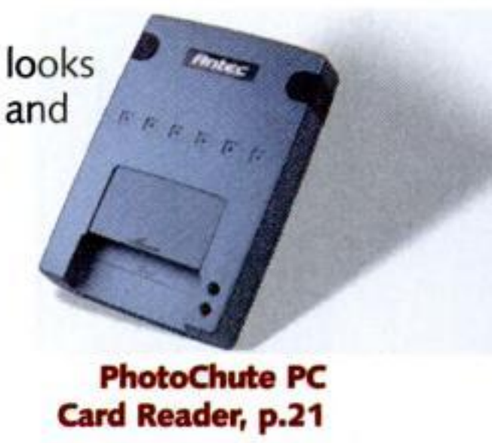

PhotoChute PC Card Reader, p.21

▶ This month we get raucous with a killer 450MHz system from Gateway, a wannabe from IBM running AMD's K6-2, Quantum's dual-Voodoo² behemoth, Philip's would-be Palm-killer, a pair of 2x8 CD-R drives, Fireworks web graphics software, Microsoft's muy macho Motocross Madness, Strata's latest 3D offering, a trio of baseball sims, and the first real PCI-based Sound Blaster soundcard.

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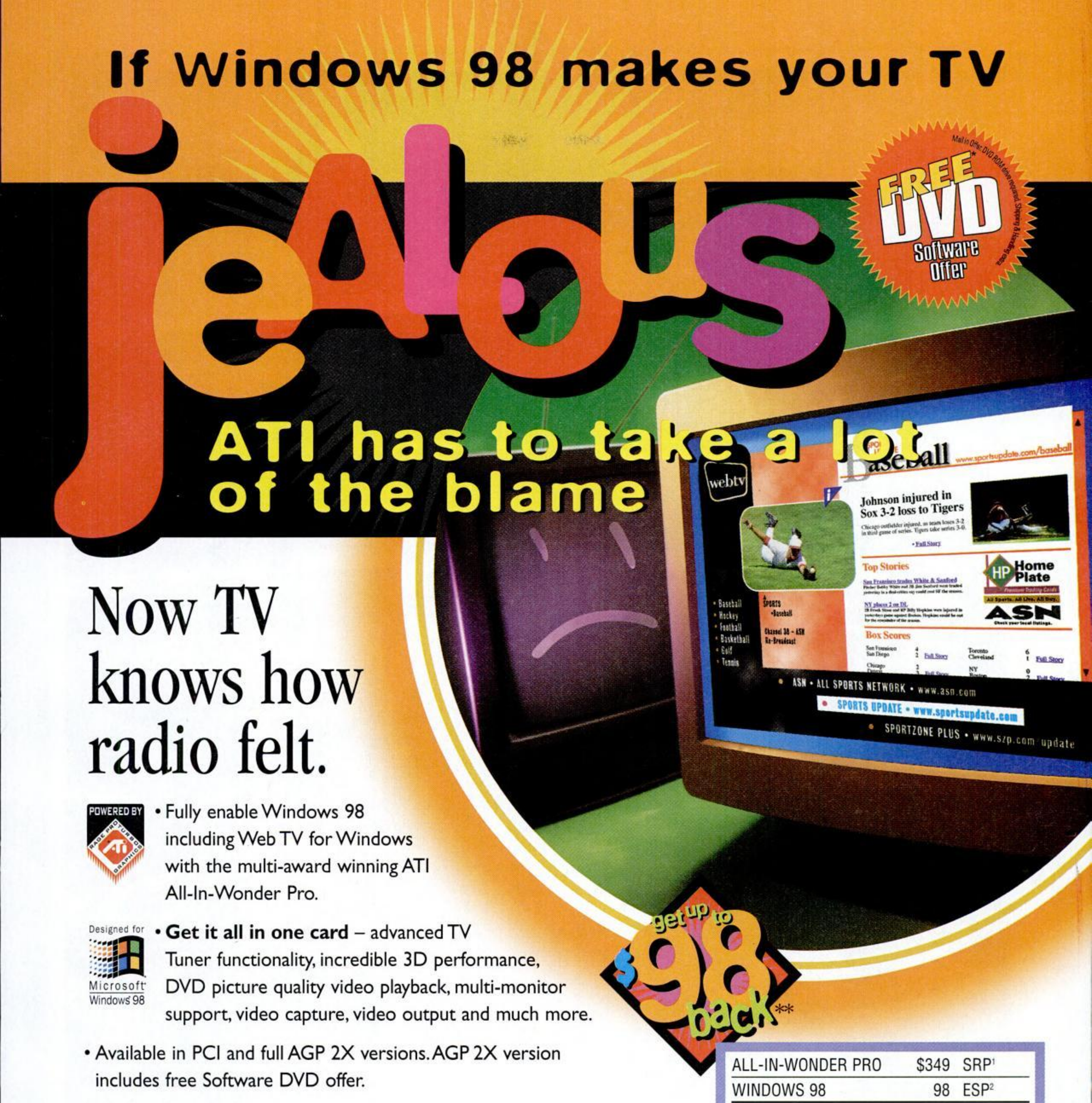
If Windows 98 makes your TV

jealous

ATI has to take a lot of the blame



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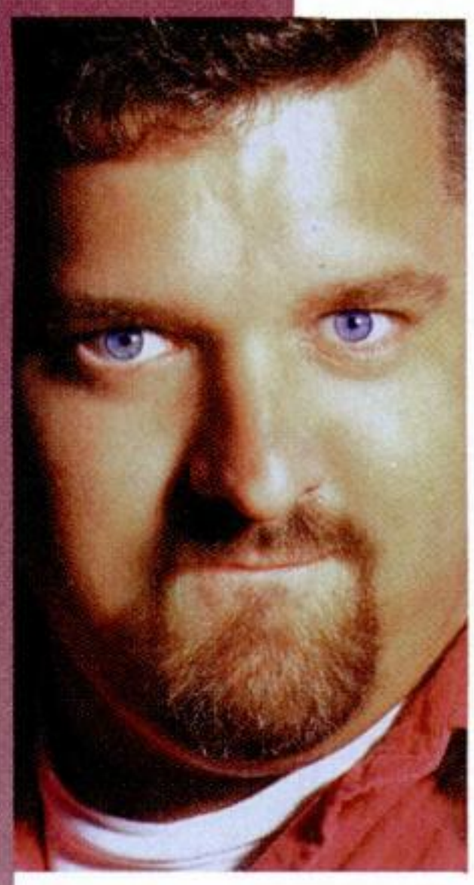
Strong Words for Strong Ideas



"Home is gone and has been replaced with evil," wrote one former HomePC susbscriber.

The first feedback to *Maximum PC* is in, and as you might imagine, it tends to be pretty passionate. Along with all the letters of praise we're receiving for creating "the ultimate magazine for experienced PC owners... finally!," we've gotten some equally strong missives against the new magazine.

Many would-be readers couldn't get past two tiny letters on the front cover: "BS" (even though we promised minimum amounts of it). We know BS is offensive, and that's why we're dedicated to fighting it on behalf of all PC owners.

Those brave enough to peek inside were then assaulted with the term "Kick Ass" (our editor's-choice award for the products that stand up to our stringent testing). Without doubt, "Kick Ass" is strong language, and we reserve it for our strongest feelings. We're a rarity: a computer magazine that isn't tepid. When we don't think something's up to snuff, we'll tell you in no uncertain terms. We don't care if the company that makes it is big or small, an advertiser or not. And when we believe a product is worthy of our readers, we make it equally clear.

These words, along with a supporting cast of equally heated terms, have earned us a fair amount of letters concerned with our eternal souls and condemning our "demonic" practices. But we sleep well at night knowing that many more readers understand that *Maximum PC* is the only magazine they can trust to deliver the truth—good, bad, or ugly.

This isn't to say we aren't sympathetic with parents who aren't comfortable sharing the magazine with their children. We respect that decision. Parenting's a rough (and rewarding) gig, and there are far too few resources for parents as is. Unfortunately, we're not willing to dilute *Maximum PC* so it's acceptable reading material for elementary school. We're bringing it to our core audience of PC owners at full-strength.

Just as reasonable people should be able to read an intelligent article about an adult activity such as smoking cigars or mixing alcoholic beverages in any magazine, we may occasionally run similar pieces. In our premiere issue, one columnist wrote about techniques and tools for getting quality porn online. This doesn't mean we endorse children doing this, just as we don't endorse children smoking stogies or drinking Harvey Wallbangers.

While we don't want to hold back our enthusiasm, we do have standards. We may make innuendo, but we stay away from blatantly explicit language. This isn't Mayberry, but it's also not Tijuana. We employ a rule of language that says, "If you can hear it on broadcast TV—which doesn't include HBO—we're free to print it." The FCC makes that call.

Sure, we could take a more middle-of-the-road, lowest-common-denominator approach. But we don't want to. We want to deliver the energy we feel about cutting-edge technology in the same excited voice friends use to share this sort of info in person. If this isn't for you, fine. There are plenty of other magazines for people who aren't into this approach or aren't up to speed on the technology. Casual readers should check out magazines such as *Family PC*, *PC Novice*, or *Easy Computing*.

You may be shocked to see a magazine recommend competing publications, but that's just one of the ways *Maximum PC* is different from other magazines.

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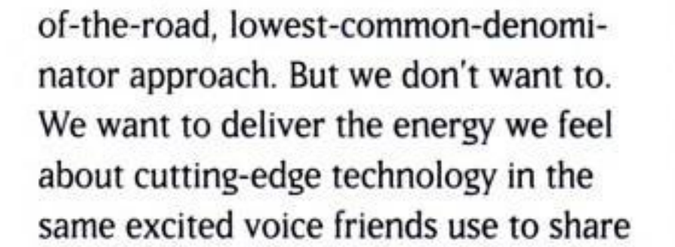

Brad "Big Daddy" Dosland
Editor in Chief

MAXIMUM PC

oct98 vol3issue09

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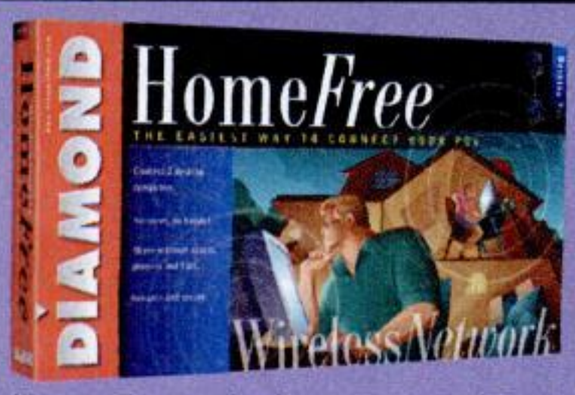

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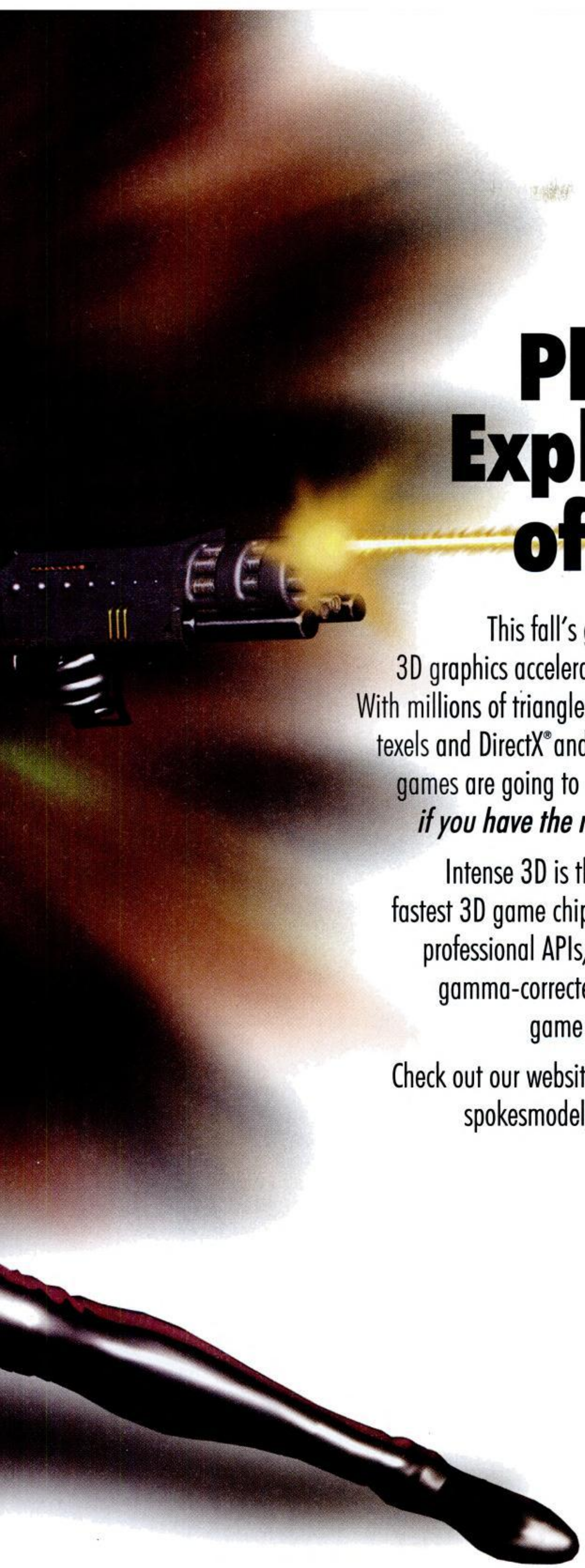

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* Some hitherto unknown alien civilizations may have better value 3D game accelerators, but we seriously doubt it.

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Letters from the Smartest Readers in the World

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Norm's Addiction

One day I'm in Winn Dixie looking through the rack for a mag with a CD. I find yours. Little do I know that this magazine isn't going to cost me just $7.99. How about $800 in upgrades? Little do I know that I will quit my job and be working at a computer store soon because of this "kick ass" addiction I picked up. I want to thank everyone involved for such an incredible magazine. Because of you, I no longer have my wife. And I am truly thankful!

—Norman Johnson

Bill or Be Billed

What are the odds of getting sued if you use Bill Gates' visage in a video game in a less-than-complimentary manner?

—Greg

Copyright, Trademark, and Video Game Attorney Alan J. Haus replies: Very high. The only way around it is that if the usage is noncomplimentary, it must not be so nasty as to be defamatory. To use his likeness at all, it must have some combination of minimal use and some social comment aspect that its use would be parody and covered by the first amendment.

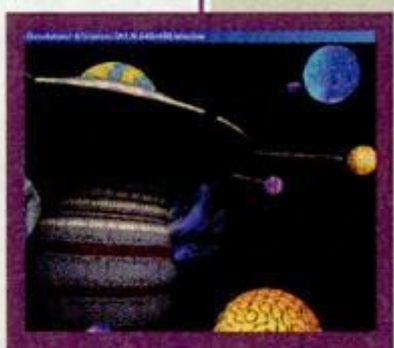
Approach the Bench

I have a beef with PC mags that use the great powerful WinBench to rate their cards. They give the "PC stupid" people the idea that a card is better than another because it got 1500 and the other card only got 1200. What the hell is a 1200 anyway? Using WinBench, one mag gave the i740 a higher rating than Voodoo^2 in 3D performance. It's time someone informs the general public that a 1500 in WinBench means jack when real-life performance is concerned.

—Eric Whalen

Senior Editor Andrew Sanchez replies: We're still wondering what the hell 1200 means! While the purpose of 3DWinBench is sound and just, the final numbers are more marketing ammo than informative. You've pointed out the one big flaw in 3DWinBench—sure, a card may do 1500 WinMarks, but how fast does it play *Quake II*? Or *Forsaken*? Or any actual game? Certain test parameters cannot be benchmarked without resorting to synthetic testing, such as fill-rate. Until game developers get off their butts and start putting code within their games to help end users benchmark their rigs, tests such as WinBench will continue to exist.

But that doesn't mean we have to use them—*Maximum PC* gives you scores that matter—average frames-per-second. This is the ultimate measuring stick we'll use to judge all videocards. We know the difference between 30fps and 60fps, and how it will affect gameplay—anyone who tells you otherwise is either insane, or just flat-out stupid.



"It's time someone informs the general public that a 1500 in WinBench means jack when real-life performance is concerned."

Mommy Dearest

I would like to clarify/explain and correct the advice concerning motherboard installation on page 61 of the first issue of *Maximum PC*. Motherboards must be hard-mounted via at least one metal standoff using no insulators at all. One can usually see some mounting holes where there is a plated-metal ring (ringlets) around the hole both top and bottom. If a hole doesn't have this, but has some traces going very close to the hole, then use an insulating washer. If one can, hard mount as many of these holes as possible, assuming these metal rings (ringlets) are around the motherboard hole and there is a threaded hole in the case, underneath this hole.

The advice given in **www.motherboards.org** is wrong!

Take a bad motherboard and with an ohm meter, you will see that this plated metal around the hole (ringlet) is connected (bonded) to the ground connection leading to the power supply. You will notice that all holes that appear to have metal ringlets are connected/bonded to the ground wire.

Explanation: At high frequencies, where these motherboards run (66MHz to 400MHz and beyond), a ground is not a ground if it is 12 inches away from the power supply. Take a piece of wire, say 12 inches, and connect that to a high-frequency transmitter. Assuming high power, one can have 500 volts in the middle and zero volts at the end. An ungrounded motherboard will have spurious emissions that might interfere with electronic equipment. More importantly, the zeros in the machine language (the Is and Os) will be noisy, causing all sorts of problems, such as halts, lockups, and perhaps even corrupted data as it is written to the hard drive.

—Michael Monsour

In Case of Fraud

I used the P-II utility included on the September 98 *Maximum CD* to check my CPU's authenticity, and it

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reported my P-II 300 was probably a fake. ECC was not present and not enabled. Do you know of any recourse, or am I just out of luck?

—Joseph Brunson

News Editor Bryan Del Rizzo replies: Don't panic. You need to contact your vendor (where you bought your machine) to report the possible fraud, and you should contact Intel at 800.628.8686 to let them know as well. If you contact Intel, be prepared to provide your contact information, the processor's serial number, and the vendor information. Good luck!

Through the Looking Glass

The computer on the front cover of the first issue is backwards. It's especially easy to tell because the wrong side of the case is opened. Someone in your art department is trying to continue the conspiracy of weird things on the cover that started with a laptop on the side of this year's *boot* magazines.

—Mike Ditty

Art Director Kevin Ashburn replies: But alas you are mistaken, Mr. Ditty! We had this English case (a right-hand driver) hand-built by a plastic cobbler in York. It took him almost a fortnight to...ah hell, you caught us, Mike. We needed to flip the machine in order to make our cover work as a gate-fold. I went in and cloned out all the product names so folks wouldn't clue-in to the flip unless they invested a cock-eyed second glance. Thanks for bringing the truth to the masses, but please realize that deception is the truest form of flattery.

"Someone in your art department is trying to continue the conspiracy of weird things on the cover."

Breast Fed

I noticed a typo in the premiere issue of *Maximum PC*. In Comm Port, the "Be Afraid, Be Very Afraid" letter has a line where Matt writes, "While Microsoft has money coming out its ears and lots of smart people working for tit...." Well, is this one of Microsoft's precious trade secrets? No wonder everyone wants to work for Microsoft.

—Steve Vo

Sisters are Doin' It for Themselves

This is in reply to Heather Walton's letter in your premiere issue: Heather, I am a 45-year-old female computer enthusiast, including computer games. I'm by no means an expert, but find I can hold my own in most discussions about computers. Like you, I sometimes find men to be dismissive of my knowledge, especially at computer stores and when talking to technical support about problems with my system.

I love games such as *Doom*, *Hexen*, and *Rise of the Triad*. What a terrific stress reducer after a rough day, to come home, fire up the computer, and beat up on mon-

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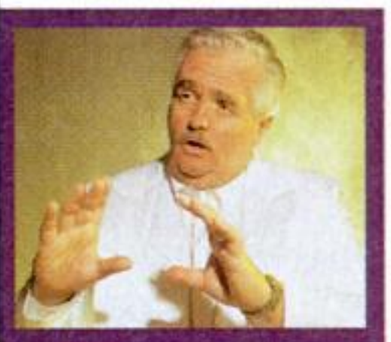
sters, demons, and assorted bad guys! I've made a lot of friends in the online gaming community and find that men seem to find it refreshing to meet women who share their enthusiasm for these types of games.

Knowledge is power in the computer age. The guys will come around eventually. Many of my friends find my interest aberrant, but so what? I'd rather be thought of as unusual than typical.

I just wanted to let you know that, while you may be "unusual," you're not alone in your interests! Our numbers may be small, but who cares? We just have to hang in there and keep learning.

—Nancy Bryan



"Holdt saying that customers were not burned by ViRGE-based cards is similar to Clinton denying he had improper relations with an intern."

Improper Relations

Are Terry Holdt and Bill Clinton twins separated at birth? Aside from the physical similarities, both seem adept at telling half-truths. Holdt saying that customers were not burned by ViRGE-based cards is similar to Clinton denying he had improper relations with an intern. Both men need to come clean! After all, Holdt has the fantastic S3 Savage3D now, and President Clinton has Hillar... er well... Air Force One to fly around in.

—Jeremy Rule

Unsafe at Any Speed

I'm a computer technician for one of the major U.S. computer resellers. Needless to say, I see many computers each day.

Let me tell you first that I am the biggest fan of the underdog. If there's something out there better than Intel, I'll be the first to buy it. In all my years in the business, I have never witnessed as many faulty processors as I see from AMD—everything from completely dead chips to strange "VxD" errors. The fail rate of AMD processors, that I've seen, is about 75%. In the thousands of Intel-based machines I've fixed in the past, I've only witnessed one bad processor. Is AMD trying to push production so fast that it's not burning them in enough? Is AMD trying to clock them up too high to keep up with Intel's climbing speeds? Or are they just faulty chips? I want to pull for the underdog, but frankly I don't see any other way than Intel.

—Corey

Getting the Shaft

Is there a such thing as a USB adapter? I have three game devices: a NASCAR Pro racing wheel, a Microsoft Sidewinder Gamepad, and a Gravis Gamepad (the older one). They're all made for the crappy old gameport. Is there an adapter that lets you connect the game controller into it and plugs into the USB port so I wouldn't have to keep switching controllers? Am I just going to be left with the shaft and have to buy all new controllers that support USB?

—Paul Hitzel

News Editor Bryan Del Rizzo replies: We've seen serial-to-USB connectors. And we've seen parallel-to-USB connectors. In fact, we've seen just about every USB adapter you can think of, except a gameport-to-USB connector. Go figure. But there could be a good reason: For every non-USB joystick, the vendor would have to create a USB driver, and that will never happen. Unfortunately, there's no such thing as a "standard" USB joystick driver.

However, based on the controllers you're using—which are all pretty rudimentary—you could purchase a joystick switch box (similar to an A/B printer switcher) that'll let you connect up to four controllers at once. Check out: CH Products' (**www.chproducts.com**) aptly named Joystick SwitchBox and Lead Pursuit's (**www.joyswitch.com**) Joyswitch Joystick Management System. Neither is recommended for digital or force-feedback devices.

The Wreck of the X-Plane Fitzgerald

Regarding the review of *X-Plane* (verdict "2" in *Maximum PC* 01), I "fly" *X-Plane* as a hobby (not doing training for a license), and I like the degree of realism—for example, the accurate flight models. Believe it or not, I bought my

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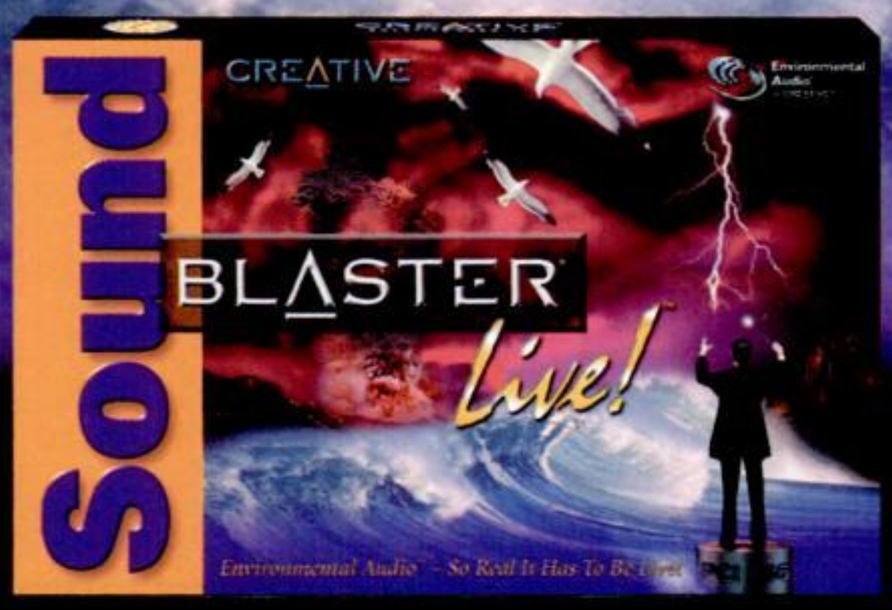

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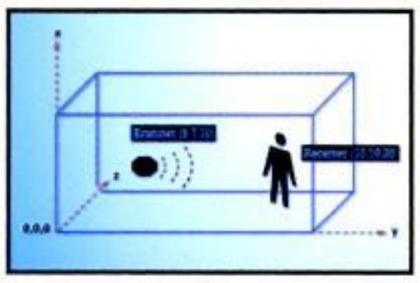
  Creative Multi Speaker Surround™, which allows real-time panning and mixing of multiple sound sources using two or more speakers. These technologies will greatly enhance audio content from the past, the present, and the future.



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first Intel PC to run the latest version of *X-Plane* on it (4.0 supports textures on my OpenGL hardware).

It is interesting that "real American marketing" á la Microsoft makes so many people buy a lower-quality product. Maybe these small and talented companies need some support in sales and marketing, and fair press coverage.

—*Stephan Buchmann*

Porn Free

I'm highly disappointed in your magazine!

My first complaint is the magazine's decision to use vulgar language in describing a "top pick" piece of equipment or software. Another is in the small print (minimum__) just below the title of the magazine. And I have to take exception to Shel Kimen's article. Internet porn is a problem, and it creates more problems. Porn creates a degradation of a society. Unfaithful marriages are not a good thing, and don't try to tell me it can enhance a marriage, because it can't. Fantasizing about other people is still adultery and fornication.

It's a shame, because there seems to be quite a bit of talent contributing to the mag.

—*Bonnie*

Cut, Copy, Paste

▶ We'll always call it straight, even when it means taking it on the chin. And that's just what we have to do with some mistakes in the first issue. A couple of transition problems jumped up and bit our system benchmarks on the ass. First was the SysMark compilation of real-world applications. At the end of the review cycle we received the new Win98 version and converted all our testing. Unfortunately, in the chaos, no one got around to telling the art staff so they could modify their graph templates to the new scale. Ugh! And at the last minute, we received the demo for *Photoshop 5.0* for our benchmarking test. So this issue features an updated test and scale.

▶ On page 118-119, The Specs for the Kenwood TrueX and Sony CDU711 CD-ROM drives were switched.

▶ In the DVD-RAM story on page 42, we misstated that the DVD Forum had adopted DVD+RW as its standard. This is not the case.

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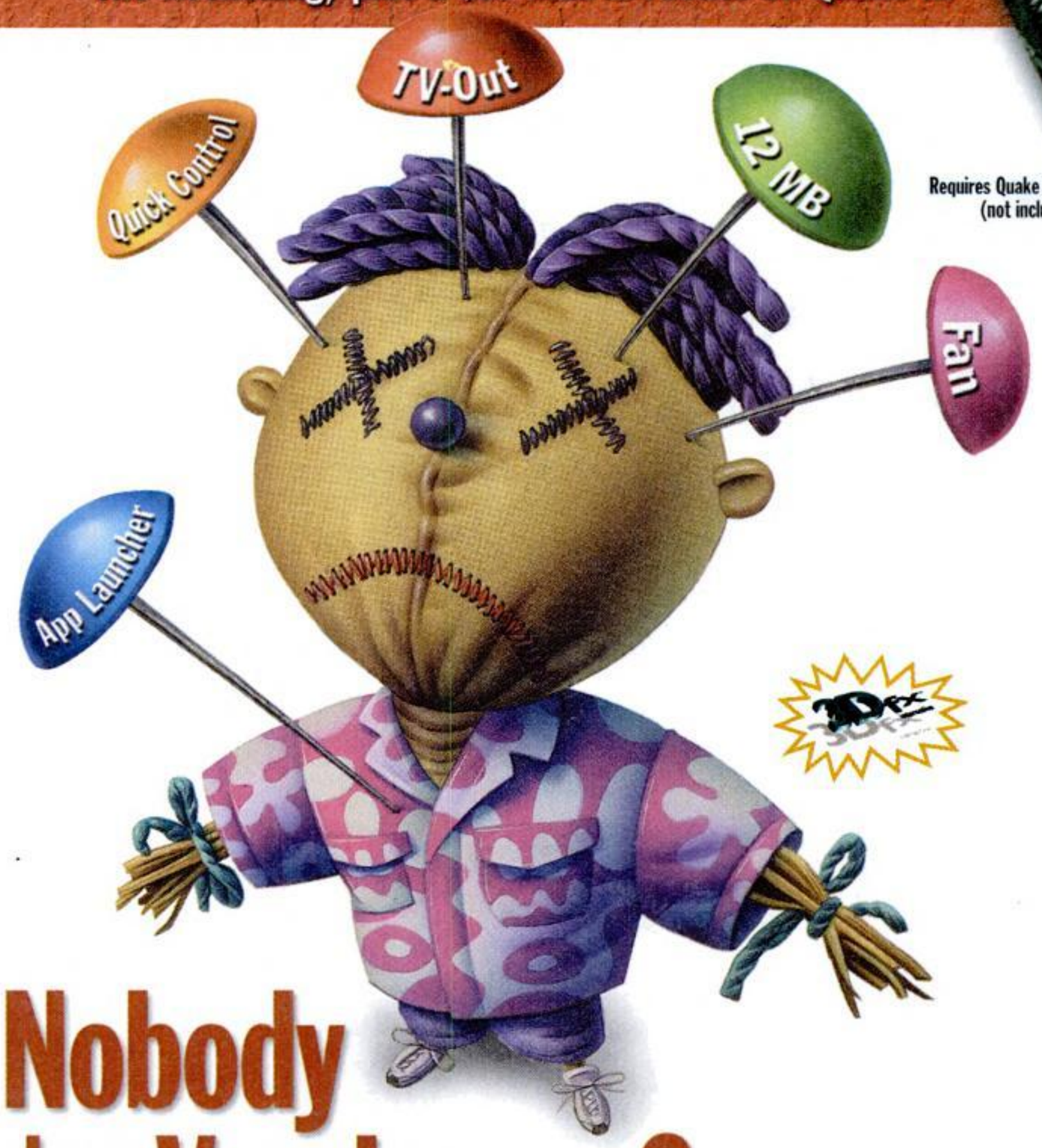

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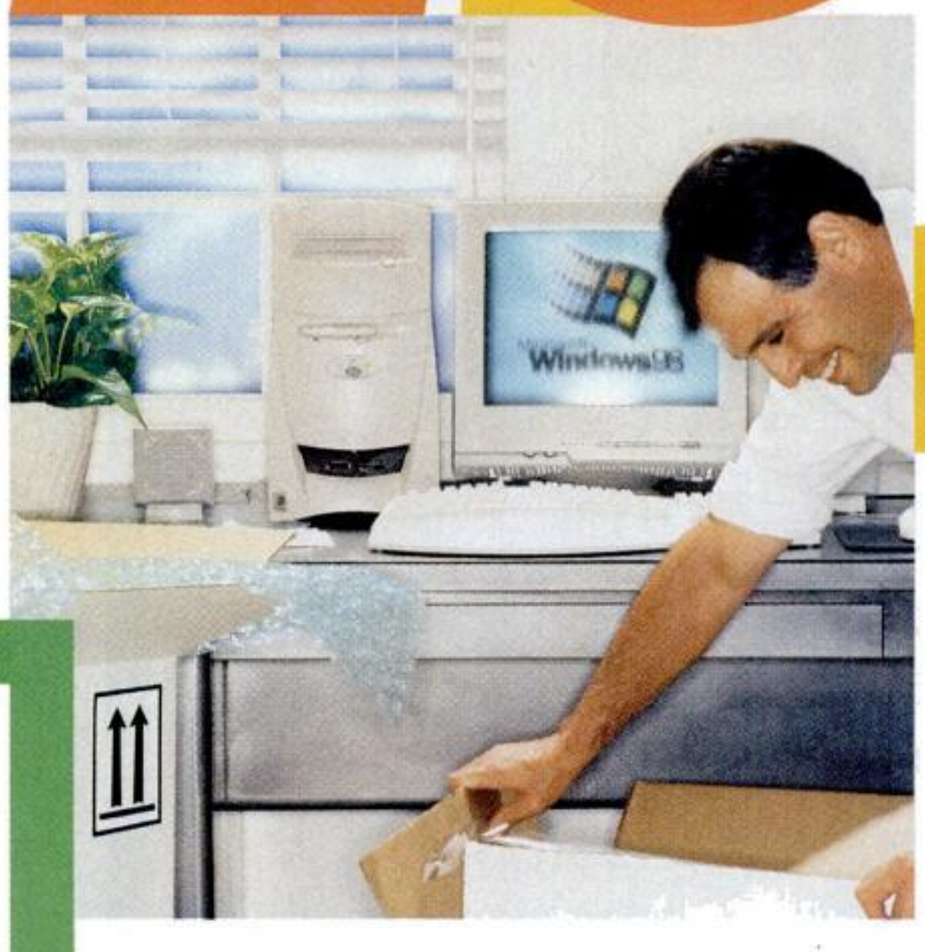

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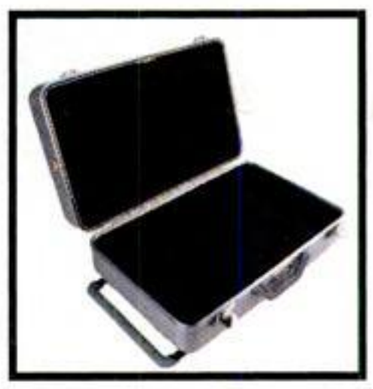

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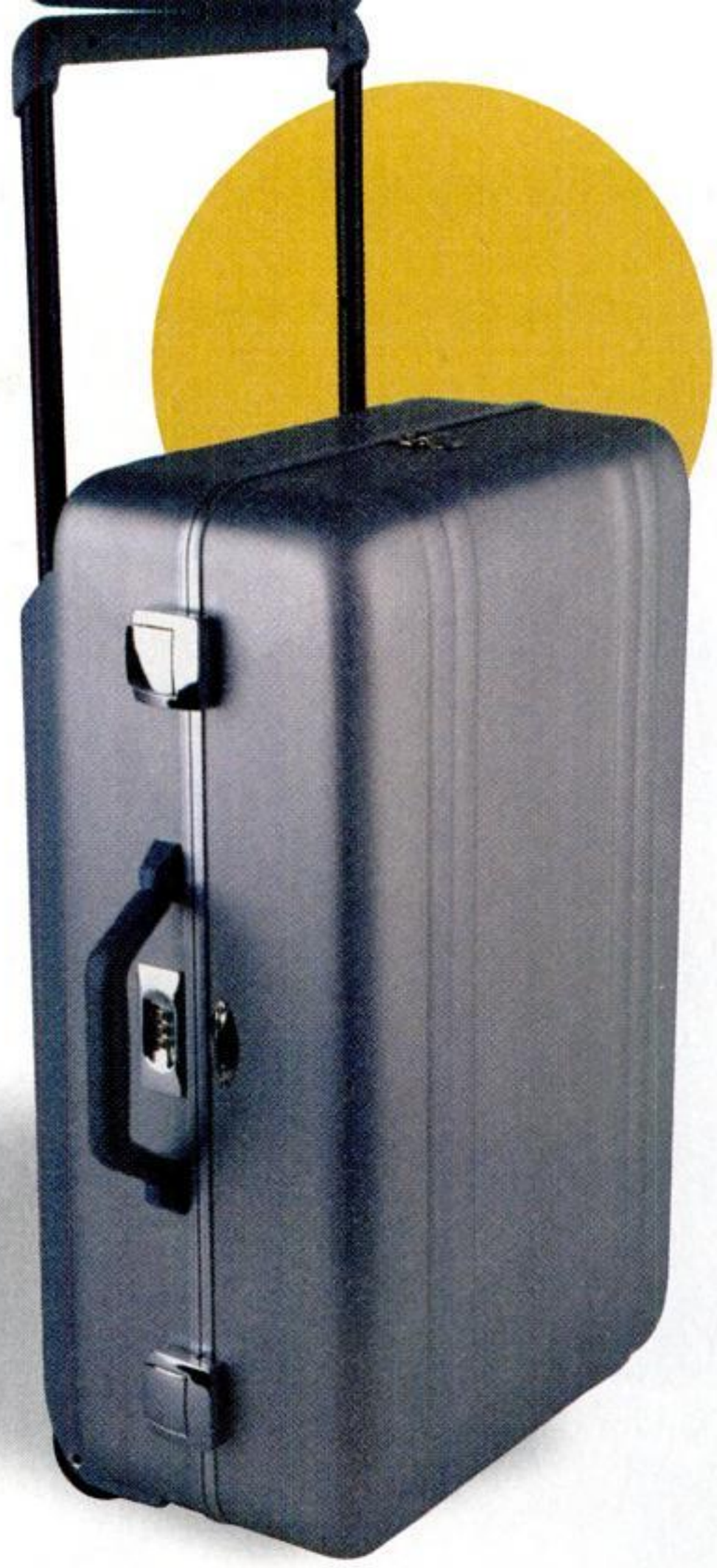

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Antec Inc.; 510.770.1200; www.antec-inc.com

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Meridian Data; 888.343.7627; www.snapserver.com

◀ Palm 2MB Upgrade

Don't let the label fool you. There's a lot more to this innocuous-sounding upgrade for Pilot and PalmPilot owners from the people at Palm. In addition to the extra memory mentioned in the name, the box also includes all the new features found in the latest Palm III PDA, including the "beam" feature for IrDA information transfers for only $129. Palm OS 3.0? Expense and Palm Mail software? New fonts and alarm sounds? They're all here. And installation couldn't be simpler.

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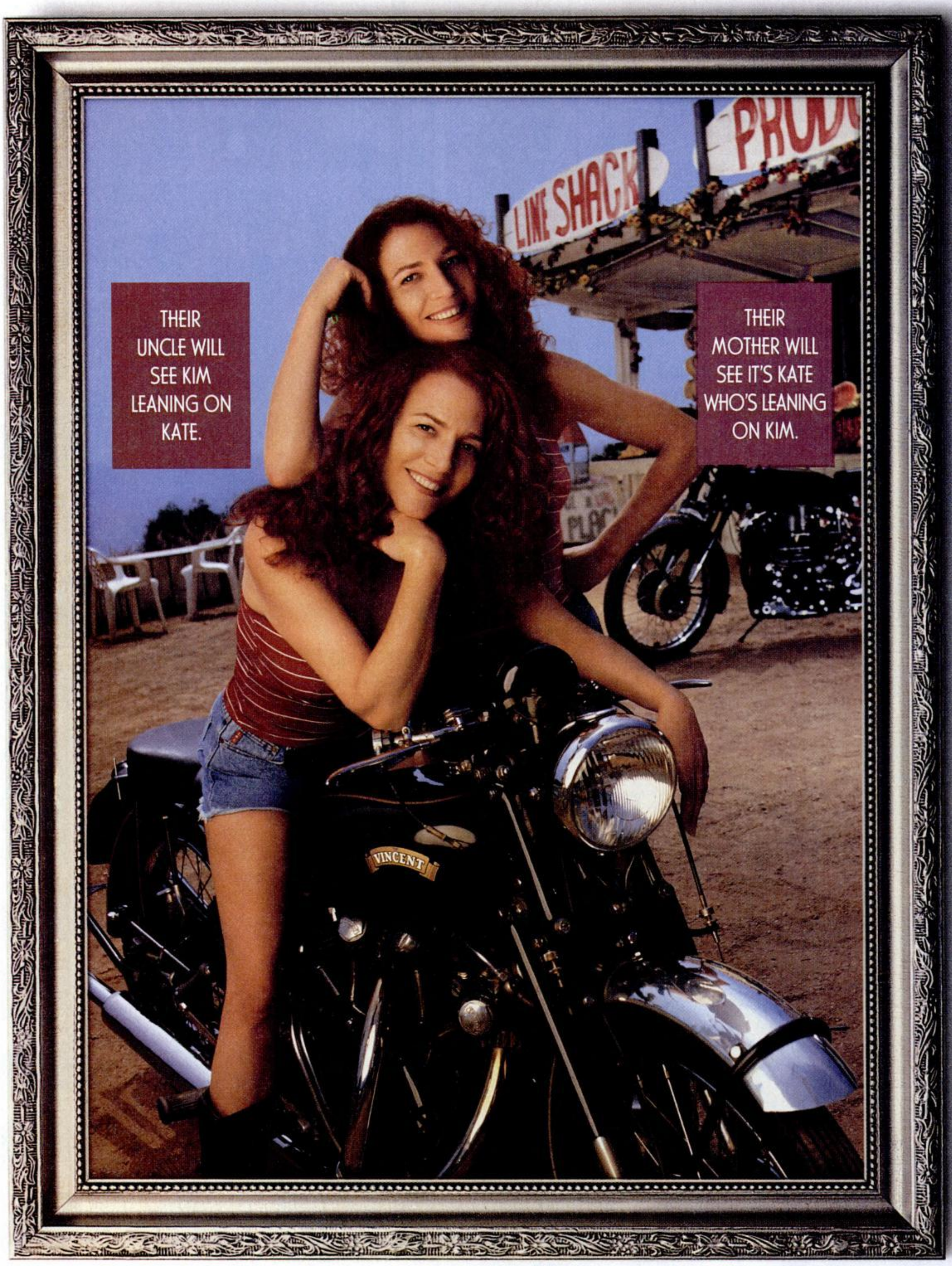

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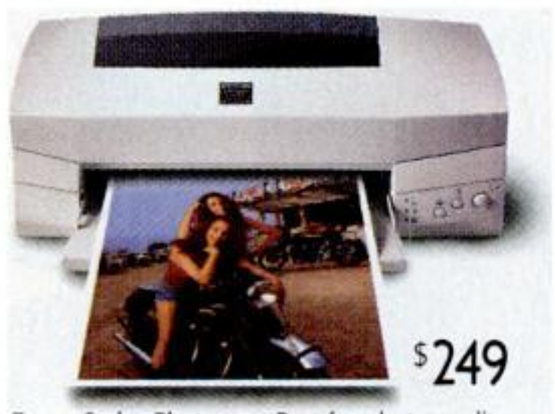

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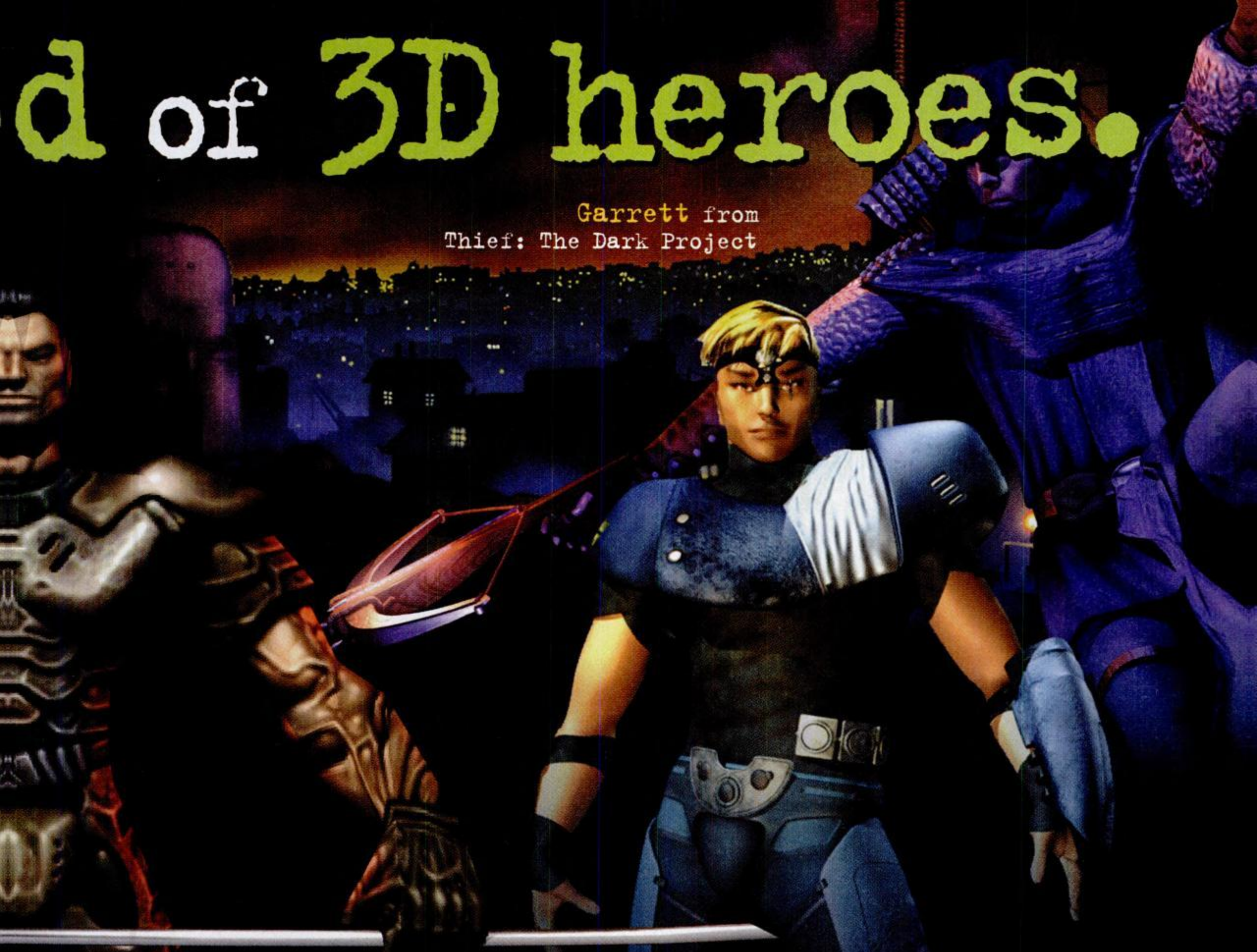

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FAST FORWARD

TOM HALFHILL
was senior editor at Byte magazine and is regarded as one of the most knowledgeable experts on processor technology in the industry. Contact him at **thalfhill@maximumpcmag.com**

Get Ready for GHz

THE RACE FOR GIGAHERTZ WON'T BE WON BY INTEL

Whatsamatter, is a 450MHz Xeon too slow for you? Can't wait for the 700MHz screamers Intel is promising for the second half of 1999? What if I told you that even 700MHz will be the slow lane for cutting-edge microprocessors by then?

Fasten your seatbelts; it's true. In 1999, chip designers should achieve one of the last engineering miracles of the millennium—a microprocessor running at 1000MHz, or 1 gigahertz (GHz). It will be the continental divide that separates processors of the 20th century from those of the 21st century. What's even more amazing is that it'll happen only seven years after processors broke the 100MHz barrier.

Who will get there first? Probably not Intel. Although Intel dominates the microprocessor business with 80% to 90% market share and invests more money in chip manufacturing than anyone in the world, two or three other companies might actually beat Intel to the punch.

Of course, that doesn't necessarily mean it'll be a knockout punch—the boxer who throws the last blow usually wins.

Three candidates for reaching 1GHz by December 31, 2000, are IBM, Digital (owned by Compaq), and Samsung (a Digital partner). That means the first chip that breaks the barrier most likely won't be an Intel x86. Instead, it'll probably be a PowerPC or an Alpha 21264.

Ironically, Digital's 1GHz chip will be manufactured by Intel.

Why is the 1GHz milestone important, and why won't Intel get there first? The answer to the first question should be obvious to anyone who reads a magazine called Maximum PC. Speed is to microprocessors what size is to Godzilla: It matters. Software keeps getting fatter and slower, gradually turning your big, fast computer into a small, slow computer. The only solutions (so far) are to stop buying new software or keep buying new computers. New computers with faster processors are a temporary cure for sluggish software, but they enable the next iteration of the cycle, which is the short explanation of how Intel and Microsoft got so rich.

The reasons Intel probably won't break the 1GHz barrier first are a little more technical. To begin with, Intel's x86 architecture isn't ideally suited for high clock speeds. And although Intel outspends everyone else on building new foundries, a few other companies (especially IBM) still have some technological advantages.

Keep in mind that Intel designed the x86 in 1978. Firmly rooted in 1970s' CISC technology, the x86 is ancient by today's standards. Intel has kept the x86 competitive with modern RISC architectures, partly by adapting some principles of RISC, but it's still a CISC chip. Intel will eventually get the x86 to 1GHz and beyond, but other architectures will get there first because they're more streamlined. For example, the Pentium II wastes precious time decoding its complex CISC instructions and translating them into RISC-like operations for internal consumption. A true RISC architecture such as the Alpha or PowerPC uses simpler instructions that require less time to decode and execute.

New computers with faster processors are a temporary cure for sluggish software, which is the short explanation of how Intel and Microsoft got so rich.

Meanwhile, other companies have been racing Intel to make chips that are smaller and faster, and consume less power. One new technology is a manufacturing process that reduces the size of transistors to .18 micron. Today's most advanced microprocessors have .25-micron transistors. (The thickness of a typical human hair is 100 microns.) Intel, IBM, AMD, and Samsung (which licenses the Alpha from Digital) all hope to introduce .18-micron fabrication processes in 1999.

On top of that, IBM is leading the way with two additional technologies that also promise higher clock speeds and lower power consumption: copper interconnects and silicon-on-insulator (SOI) transistors.

Copper conducts electricity better than aluminum, so chips with copper interconnects run faster and use less power. IBM has found a way to mass-produce copper-based chips, and the first PowerPC processors with copper layers are appearing this year in IBM servers and workstations and Apple Macintoshes.

In August, IBM announced the commercial introduction of SOI, which adds a new insulating layer to the chip sandwich that allows the transistors to change states (switch on and off) more quickly.

Earlier this year, IBM made a big splash by announcing an experimental PowerPC chip that runs at 1GHz. Although it was certainly a worthy achievement, few people realized how experimental that chip really was. It ran only a subset of the PowerPC instruction set (no floating-point instructions, for instance) and didn't even have an I/O bus. To load programs on the chip, IBM had to inject the signals with a specially modified probe that touched bare contacts on the unpackaged die.

PC users are willing to put up with a lot of crap to install software, but even Microsoft doesn't ask us to go that far.

When will Intel's x86 reach 1GHz? I'd guess late 2000 or 2001. Hell, AMD's K7, which will use copper technology licensed from Motorola, might even beat Intel.

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ON THE LINE

voices

SHEL KIMEN
has worked in the industry, traveled the world, and covered the Internet for both The Net and boot magazine. She can be contacted at **skimen@maximumpcmag.com**.

High-Speed Access, Finally

ISDN, CABLE, AND ADSL MAKE A BID FOR THE MAINSTREAM

Call me skeptical, but I'm finding it harder and harder to embrace the possibility of ubiquitous broadband Internet access. Everyone wants it, and every telecom company, cable outfit, and modem manufacturer on the planet is full of promises.

So where is it?

Before broadband can become "ubiquitous" we're going to have to decide which fat pipe people want running through their homes: ISDN? Cable? Now the word on the street is ADSL.

But this is not new technology. GTE and AT&T offered ADSL trial runs as early as 1995. It's not so obscure either, with companies ranging from Microsoft, to British Telecom, to Motorola, to Cisco invested in its success. But like all technologies, ADSL's popularity wavers.

Springtime blossoms with love, especially in France. This spring, French telecom technology giant Alcatel got involved with ADSL. Alcatel (**www.alcatel.com**) supplies at least 130 countries with broadband equipment, interface products, and mobile communication systems.

Alcatel and 3Com (**www.3com.com**), the world's leader in personal Internet access, announced an agreement to collaborate on interoperable ADSL. You can use your 3Com modem with Alactel services, or vice versa. The agreement facilitates a giant leap toward ubiquity, if you ask me.

With nearly a quarter million customers across the southeast United States, BellSouth.net (**www.bellsouth.net**) has announced a plan to offer ADSL service via Alcatel modems by the end of 1999. End of 1999? That seems far away. The company did say, however, that it plans to begin this service in August in eight locations; Atlanta, Charlotte, and New Orleans are among the lucky.

I popped over to the ADSL Forum site (**www.adsl.com**) to get an idea of just how many other companies were already offering service or planning trials, and the findings shocked me.

ADSL is already operational in Chicago, San Francisco, New York, Helsinki, Madrid, Brussels, Tel Aviv, Tai Pei, etc., etc., etc. In fact, the ADSL site has a whopping 28-page Excel spreadsheet of participating cities and trial programs. Also at this site is a list of forum member companies, dozens of which are in the Fortune 500, and also the ADSL Board of Directors, commanding from the likes of Ericsson, Motorola, and Ameritech. Big players are interested in the viability of ADSL.

But what about cable access?

Technologically, there is little noticeable difference. ADSL races at up to 9Mbps, but most mainstream services will offer what is called "ADSL Lite" at 1.5Mbps to accommodate "splitting" the phone line for both voice and data transactions. Some critics claim that because of this cable modems are faster, with speeds up to 10Mbps. It should be noted though that cable modems share a line with dozens of other users, so the speed will drop as users log on. On an ADSL line you will be the only user on your line, which means you'll get better security and greater reliability.

According to Kim Maxwell of Independent Editions, "Cable modems typically offer a downstream data stream out of one of the 6MHz TV channels that occupies the spectrum above 50MHz (and more likely 550MHz) and an upstream channel carved out of the currently unused band between 5MHz and 50MHz."

She continues that ADSL "realizes downstream speeds up to 9Mbps, but upstream speeds up to 640Kbps. As ADSL operates point-to-point, it does not need media access control, and each user gets the full rate available continuously." This and everything else you could ever want to know about cable and ADSL can be found in Maxwell's article at (**www.adsl.com/PressRoom/adsl_vs_cable.html**).

The largest advantage of ADSL is the simple fact that many lines are already available, as opposed to the infrastructure that needs to be built for other high-speed solutions. Obviously more people have phone lines to their homes than have cable TV lines.

The cost of service for both is about the same. BellSouth.net will charge between $50 to $60 per month, including unlimited Internet access, with one-time charges of $200 for equipment and $100 for installation. GTE (**www.gte.net**) announced that its ADSL service would cost about $40, not including unlimited Internet access, and there was little information available on the company's web site. Time Warner's Roadrunner cable modem service costs about $50 for personal users and $80 for business users. There's another excellent resource for high-speed access information at **www.specialty.com/hiband/**. It's updated regularly and worth your time—even at 28.8.

The largest advantage of ADSL is the simple fact that many lines are already available, as opposed to the infrastructure that needs to be built for other high-speed solutions.

Skepticism aside, high-speed access might not be so far off, especially for those living in large metropolitan areas. My bet though is that you'll get an offer from your phone company a lot sooner than you'll hear from your cable company.

Just a hunch.

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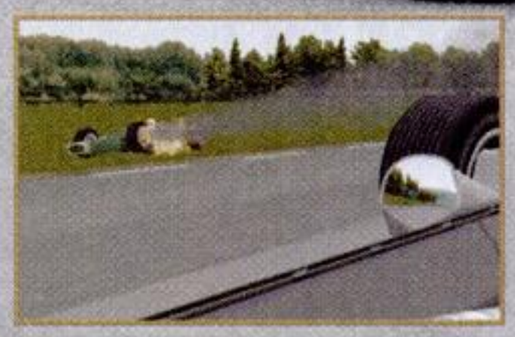

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GAME THEORY

T. LIAM MCDONALD
is a veteran of PC Gamer magazine and is much bigger than he looks in this picture, so keep that in mind before writing him any hate mail at **tmcdonald@maximumpcmag.com.**

Proof the Game Industry Hates You

BASED ON THE LITANY OF NITS THAT INFEST GAMES, IT'S THE ONLY CONCLUSION

In the course of playing games day in and day out, gamers develop a set of pet peeves that ossify into bitter hatreds. It's not merely thinking, "My, that install program is a touch off." More like, "If these jerks replace my drivers once more, I'm gonna kill them and sell their children into slavery and barbeque their gold fish!"

Take, for instance:

Mandatory Trailers

Gamers are more upset about this than about global warming. The main culprit is Interplay, and it is one of the most pernicious practices found in any quarter of the game business. Interplay games, between completed installation and first running, include a protracted trailer for one of its upcoming titles. You cannot skip these trailers! I flail at my keyboard like a spastic cat trying to get the blasted things to stop, and they won't—until they've run to the bitter end. After rebooting to prevent one trailer from showing, it remembered that it hadn't played and refused to let me into the game until it had. All we can do is weep and howl, "I don't want to watch the Secret of Vulcan Fury ad again!"

Replacing Drivers

Microsoft is like the Borg: it won't be happy until you are absorbed into the collective. DirectX is its insidious Borg cube of installation routines that happily and randomly replaces your drivers whether you want it to or not. I like my videocard's native ATI driver. It's faster and works better at the high resolution I use. But one after another installation program goes through and, without asking my permission, replaces my native driver with a clunky DirectX driver, like a kid who glues all your CDs together and then offers only a grinning, "Look what I did!" Leave my steenkin' drivers alone!

Other Install Irritations

DirectX driver replacement is cousin to a whole suite of general installation annoyances: installs that don't bother to check for available space, only to bomb out after you've spent 15 minutes watching the little blue line inch toward the 100% mark; installs that require rebooting without an option to bypass; installs that perpetually nag you to Register Your Games! (Why? What's the benefit, other than more junk mail?); and uninstalls that don't actually uninstall the whole game, leaving large chunks of code on your hard drive. The aggravating Sierra install utility earns its own special place in hell for inflexibility (you can't reset the path), placing icons on my desktop, and refusing to remove itself after an uninstall. Look, just put the goddamn game on the hard drive and don't screw with my system, OK?

Keyboard Madness

Nothing is more frustrating than an improperly mapped keyboard that cannot be remapped. The Europeans have turned this into an art, with mind-scrambling key combinations such as CTRL-X-% for firing guns—unless it's the third Tuesday of the month. We need to sit down in the sweat lodge for a week with all the game developers and force them to agree to a "Universal Keyboard" with sensible assignments such as spacebar for fire, F for flaps, L for landing gear, and so on. Those who refuse to include remapping in their games will be forced to play Spiceworld for 20 hours straight.

The aggravating Sierra install utility earns its own special place in hell. Look, just put the goddamn game on the hard drive and don't screw with my system, OK?

CD Cases

A CD is an easily damaged delivery medium for an expensive product that may cost millions of dollars to develop. So, of course, cheap-ass publishers ship their discs in little paper or cardboard sleeves. Cardboard sleeves, such as those used by Interactive Magic, are annoying because they combine flimsiness with an innate ability to scratch the CD. The paper-and-cellophane sleeves are simply the last gasp of the skinflint. No CD should come shipped in anything but a jewel case.

Packaging

The "air box" is one of the fabulous marketing inventions designed to take up precious shelf space and annoy consumers with the faint justification of "added visibility." Merely getting to the game through a shrink-wrapped box and a shrink-wrapped CD is like trying to get through the childproof cap on the aspirin after a pint of Jameson. (What are they afraid of? Cyanide tampering?) Once inside the box, you find wads of cardboard folded in origami-like shapes to disguise the fact that the only thing in the box is the CD. This phenomenal waste of paper was clearly designed by people who hate you.

And the niggling things game companies do to irritate us take on epic proportions when multiplied hundreds of times a year.

Have a bitch? Send it to me. I'll compile them and send them to someone in the computer gaming industry who cares.

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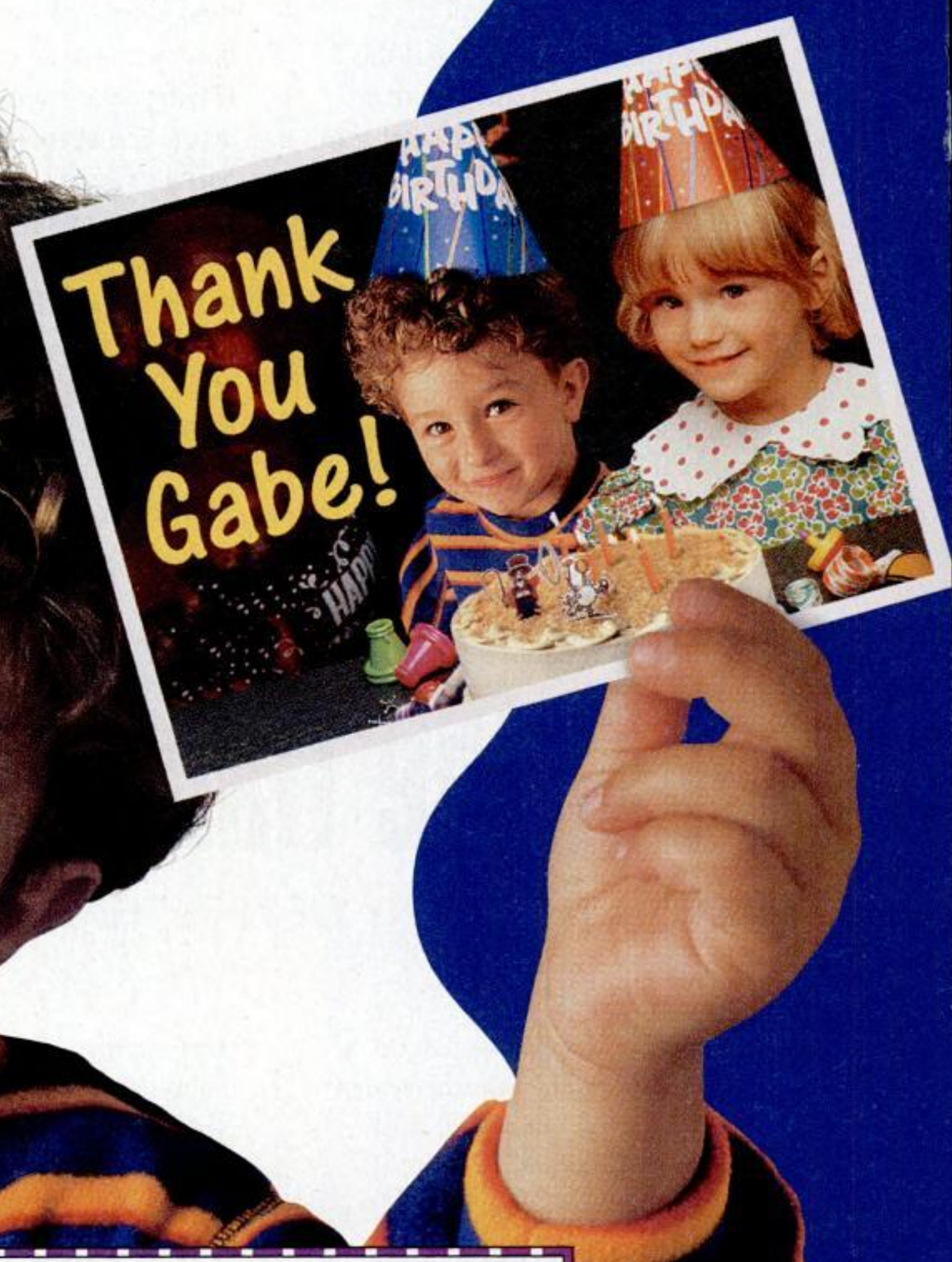

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WATCHDOG

▶ Maximum PC stands at the gate between you and them

BANNED FROM BEST BUY ▶

All Blaise Frazier wanted to do was benchmark some machines at his local store. Instead, the 14-year-old boy and his mother found themselves banned from the **Best Buy** in Stone Mountain, Georgia, after a store clerk saw him installing software.

"(The clerk) proceeded to tell me we were doing criminal activities, would be escorted from the store and never permitted there again," said the boy's mother, Candy Frazier.

The CD in question was a free disc from *boot* magazine. Frazier has a budding interest in PCs and was curious about the new machines on display, his mom said. Frazier said her son had loaded software on machines with permission at Office Depot and the same Best Buy before without a snag and assumed it was OK this time too.

The clerk simply overreacted, Frazier said. If there was a problem the clerk should have politely asked Blaise to stop and give the reasons why. She's been hoping to get an apology and more information on what was "illegal," but has gotten nothing but the runaround.

Frazier's last resort was to turn to **THE DOG**.

THE DOG called the store, but the manager refused to speak. A store employee who declined to give his name reiterated that Blaise's actions were illegal, but could not cite what penal code was violated.

Not satisfied with an anonymous answer, **THE DOG** sniffed higher up the chain of command and contacted Best Buy's corporate HQ in Minnesota.

Donna Fierko with Best Buy's public relations department said the company's policy does not allow customers to load software onto demo machines.

"It's just a consumer-safety issue. There's too much liability there," Fierko said. "We also don't allow people to bring in their own video tapes and put them in our VCRs."

Fierko said Best Buy eventually sells the demo machines and doesn't want to risk having them damaged by an errant virus.

As to the Fraziers being booted out permanently from Best Buy, Fierko said she believes it would be highly unusual and apologized if someone overreacted.

"If she was treated in that way I apologize. It might have been just a misunderstanding."

When told of Best Buy's official response, Candy said whether they've been banned from Best Buy is moot at this point.

"I wouldn't go back there anyway," she said. "In my opinion they don't care about the customer. I left three phone calls at their corporate offices and not a single person bothered to call back. The fact that they didn't offer an apology at first speaks volumes on their policy toward customers. We have two computers at home and my son makes a list of things to buy at Best Buy. Now, I'll just take my business elsewhere."

Although she knows they didn't do anything wrong, Candy said she won't allow her son to load software at a store again after all this trouble.

What's THE DOG's advice? Get clear permission from the store manager or someone in authority before sticking your disk in, or you may get bit. Several other large computer retail chains such as CompUSA have official policies that forbid customers from loading software on demo machines. The reasons are the same—fears of piracy and too much associated downtime putting machines back online after someone crashes it. Your local store may have a different policy. If you want to test a certain game demo or benchmark on a machine before buying and the store won't let you do it, speak with your dollars and go somewhere where you can.

HP UNSUPPORTIVE ▶

I bought an **HP 4020i CD-Recorder** about two and a half years ago. I was relatively pleased with the product until I started playing with the **Windows 98 beta**. The drive wouldn't work. I chalked it up to a flaw in the beta OS and used my trusty Plextor 4x for all my CD-ROM needs. For CD burning, I installed Windows NT 4.0, where the HP drive works very well. I recently purchased Windows 98, thinking it would finally alleviate my problem. To my surprise it did not. I called HP tech support and was happily told by a tech that the 4020i does not work beyond **OSR2.1** (with supplement). I asked when there would be a fix for it and was told there will be no fix—that product was sold supporting Win95 only. This is simply wrong. How do corporations make a product, then simply slide it off their plate when it's convenient? I hope they're not taking this same mentality and applying it to their printers, scanners, and systems. I consult many, many people on their buying decisions, and I'm glad I no longer have to track such a manufacturer.

"I asked when there would be a fix for it and was told there will be no fix—that product was sold supporting Win95 only. This is simply wrong."

—Ken Tope

THE DOG rang Caroline Brown, public relations manager for HP consumer devices in Colorado about Mr. Tope's

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issue. She said the technician had misinterpreted an HP policy. "We didn't test those products for Windows 98, but we are assuming they work. We support all our products, that's what this call-center employee should have said. There's nothing that HP sells that we don't support." Brown offered to have a technician contact Mr. Tope about resolving his problem.

At press time, Mr. Tope hadn't been contacted by HP yet, but we're sure HP's word is good. If it isn't, you'll hear about it from the Dog directly.

QUANTUM SNAFU ▶

"I didn't once get an apology on the phone, and I got stuck paying because of the order glitch."

I pre-ordered a **Quantum3D X-24** around the start of May for more than $700. I don't usually pre-order items, but the hype, and Quantum3D's reputation for not being a run-of-the-mill videocard company, convinced me to take a gamble. I later changed my mind and canceled the order.

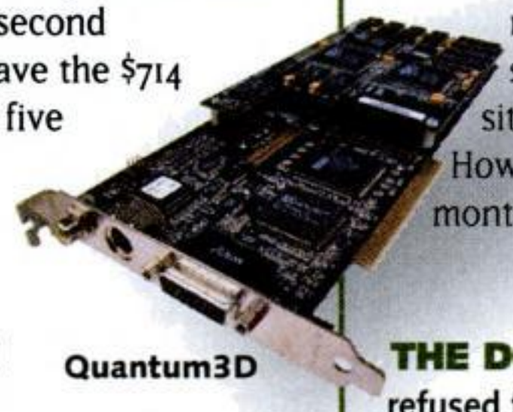
Despite the order being confirmed as canceled by Quantum3D, about a month later a package from them showed up. I was shocked—and so was my checking account. My account was hit for $714, and since I wasn't expecting this I had to pay through the nose in overdraft charges.

The day the box from Quantum3D arrived, I refused it and had UPS send it back. I also contacted Quantum3D and was told by an employee that a glitch in the order system screwed me. It was like I should expect things like this to happen! It's my hard-earned money. I can cancel an order, just like I can place an order.

The employee said the second Quantum3D receive my card I would have the $714 refunded. It took a month and at least five phone calls to Quantum3D before I received my refund.

I didn't once get an apology on the phone, and I got stuck paying because of the order glitch. The worst thing is, I still don't have a 3D card and am stuck in the horrible software-rendered world of gaming.

—Frank Amato



Quantum3D

THE DOG knows Quantum3D's boards give people hot flashes, but not like this. The Dog contacted Chuck McMakin with the company's telesales and web sales team, who had an honest answer for the mistake:

"Quantum3D sincerely regrets any distress or inconvenience that we have caused Mr. Amato. Although we don't believe there is any excuse that justifies the mistreatment that he appears to have experienced, we would like to offer an explanation.

"Quantum3D had been outsourcing the electronic commerce portion of our web site. Due to a variety of difficulties that Quantum3D experienced with the provider of these services, we eventually terminated our business relationship with that vendor. We have verified that this situation played a role in the failure of our system to appropriately cancel Mr. Amato's order.

"The individual that appears to have compounded Mr. Amato's disappointment with our quality of service is no longer a Quantum3D employee.

"We firmly believe that the changes we've made regarding our electronic commerce and certain customer-service personnel have returned the quality of Quantum3D's service to a level of excellence that our customers have every right to expect.

"We would welcome the opportunity to make amends with Mr. Amato. We are contacting him directly in an effort to apologize and discuss an appropriate resolution."

THE DOG gave Mr. Amato a chance to chime in on Quantum's response.

I heard from a Quantum3D employee last week who said that Quantum would give me credit for the overdrafts, about $114, toward a new videocard. I decided to pass on it and take the cash instead. I sent them a copy of my account history to prove the losses. In closing, I hope people are more cautious of pre-ordered items, and hyped ones at that. I'd hate to see someone else get burned like this again. It's not a fun thing to go through. Especially when you work hard for your cash.

—Frank Amato

JTS IN THE DOG HOUSE ▶

I have a huge problem with **JTS Corp.'s customer-service** department. After I started having problems with a JTS hard drive I bought in April, I called to replace it in August. I sent it by U.S. Postal Service Priority Mail on the two-to-three-day schedule. After a week, a JTS tech told me it hadn't been received yet. I called a few days later and was told it would take from four to six weeks to replace the drive. I don't know how JTS can offer such a slow turnaround and still claim on its web site that it has a seven- to ten-day RMA turnaround. How am I supposed to do without my computer for a month? I'm never buying a JTS hard drive again.

—Michael Chernous

JTS Hard Drive

THE DOG contacted a JTS marketing representative, who refused to comment on the apparent discrepancy in return policies. The person did say the company stood behind its warranty service but was at a loss to explain the inconsistencies between what Mr. Chernous was told and what the company's web site advertises. The marketing employee also refused to connect the Dog with a manager whose tongue wasn't tied, instead saying someone would "call back." At press time the Dog was left hanging and numerous calls to JTS's customer service department during different times and days ended in voice mail grinders. Until further word, consider this company and its service in the Dog House. Aroof.

Got a bone to pick with a vendor? Get spiked by a fly-by-night operation? Sic the dog on them by writing watchdog@maximumpcmag.com. The Dog promises to get to as many as possible, but only has four paws to work with.

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Cu Next Year

Copper chips herald the next-generation of blazing-fast microprocessors

Man has used it for thousands of years. The ancient Egyptians held it as their symbol for eternal life. So why is copper now being coveted by the microprocessor industry?

In a word, speed.

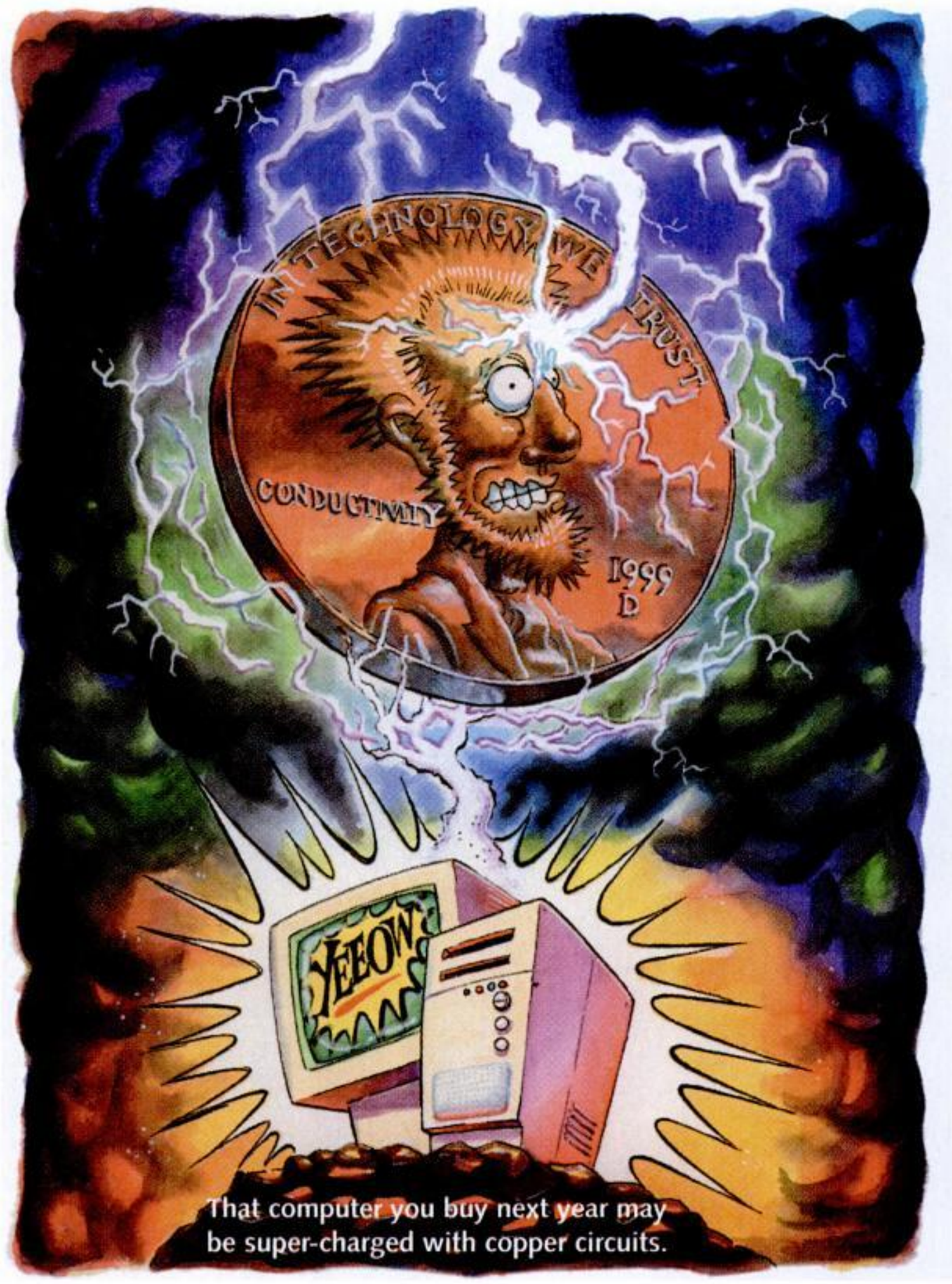
For the last 30 years or so, microprocessors have used silicon wafers that included aluminum circuits. But in their never-ending quest to build better and faster processors, chip companies realized they would have to overcome aluminum's limitations—namely its conductivity level—if they ever hoped to build chips smaller than today's .25-micron processors.

"Really only four metals have been under consideration for semiconductors: aluminum and silver, both of which are pretty consistent and have similar electrical properties; and copper and gold," said Howard High, Intel's Strategic Communications Manager. "In looking at those two groupings, however, it was very logical, and somewhat predictable, that aluminum and copper would be the choices, because of their lower costs and greater abundance."

The process involves the microscopic, interconnective wires that connect one layer of transistors on the silicon to another. The goal is to make the electricity flow through these wires as efficiently and as fast as possible. But the challenge facing engineers was what to do when the resistance of the material—in this case aluminum—began to impede the rate of the signal when the entire chip was shrunk. Engineers knew copper conducted electricity better, but there was a major hitch: If copper comes in contact with silicon, it can contaminate and destroy the silicon's inert (or nonconductive) properties, diminishing the chip's reliability and stability. The interaction between the silicon and the copper doesn't happen at a given phase; these materials don't get along at the core.

"By the year 2000, we'll be ready and able to deliver a GHz-rated processor using aluminum. But copper will allow us to go even higher."
—Howard High, Intel's strategic communications manager

The solution was to build an insular layer between the two materials (the same reason we cover wires with rubber to prevent electrocution); the trick is making sure the barrier is permanent and impregnable. But in 1997, two companies—Sematech (a consortium of 16 chip companies, including Intel, AMD, Motorola, and Rockwell) and IBM (after nearly 15 years of research)—made waves when they announced they had devised ways to build copper



That computer you buy next year may be super-charged with copper circuits.

ILLUSTRATION BY SCOTT PECK

SPIN CYCLE

This month's top stories broken down ►

HEADLINE	NEWS	DETAILS	QUOTE	OUR TAKE
ATI Unveils New Rage 128 Chip	ATI's next-gen 2D/3D accelerator chip, Rage 128, aims to take down nVidia's TNT chip and deliver faster, high-quality, 2D and texture-mapped polygon gaming.	Dual 3D processor gets you single-cycle multitexturing, trilinear mip-mapping, 32-bit Z-buffer, support for 32MB of SGRAM/SDRAM, and hardware DVD decoding	"Its performance and feature set establishes a new level of excellence for the graphics industry," said Ed Grondahl, ATI's vice president of marketing.	ATI kept this part on the serious QT. If it can deliver the performance alongside some excellent rendering quality, TNT may have serious competition.
Elsa Buys Hercules	Elsa has acquired Hercules Computer Technology, the pioneer of the PC graphics card industry, for about $8.5 million.	Elsa will keep the Hercules name alive for its extensive line of consumer-grade videocards; products marketed under the ELSA name will continue to be workstation-driven.	"Elsa's first acquisition is a major strategic step on our way to becoming a global player," said Theo Beish, CEO of Hercules.	As long as Elsa continues to drive innovation and technology, we're happy.

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Copper: The All-Purpose Element

We scoured the web for exciting copper technologies, but came up short—until we stumbled upon the Copper Development Association's (CDA) web site (**cutopics.copper.org**). The CDA's sole purpose is to highlight market development news of the copper and brass industries. Here are some of its highlights:

UGLY BUGS Copper blocks the growth of ugly, energy-robbing algae that invade roofing. To inhibit the airborne algae-gloeocapsa magma, which cause dark, heat-absorbing streaks on asphalt shingles, manufacturers have developed systems for dispersing algae-preventing copper ions over roofing shingles.

LIGHTNING PROTECTION Copper is the most popular material used in structural lightning protection for several reasons: One, its superior current-carrying capacity; two, it's much easier to work (copper cable bends easily compared to brittle aluminum); and three, it's aesthetically pleasing (exterior copper wiring weathers to what the CDA terms "a pleasing, dark shade").

RAILROAD The latest diesel/electric locomotives now use AC-induction drive motors with fabricated copper rotors instead of DC drive motors for more power, higher efficiency, longer life, less maintenance, and greater resistance to environmental extremes. Copper is also helping the railroads gain market share from long-haul truckers. More than eight tons of copper have been used in the latest, most-powerful locomotives, enabling them to pull longer trains faster up steeper grades.

JEWELRY Copper is supplied in many forms to the jewelry trade for alloying with precious metals or as "white bronze" or "jeweler's manganese bronze."

COOKING Copper-bottom ware was introduced in 1939 when metallurgists with Revere Copper and Brass developed a new way of electroplating a half-millimeter of copper to the bottom of utensils made with stainless steel. Later, a line of premium cookware was created with a disk of 1.5mm copper brazed to 1mm thick surgical-grade stainless steel.

MUSSEL REPELLANT Copper repels zebra mussels, a regional aggravation fast becoming a national menace. The incredibly fertile, thumbnail-size mollusks plug up pipes that carry water to towns, factories, and steam turbines. High copper alloy screens over the pipe intakes are one of the best antidotes, because the mussels don't adhere to the durable screens.

metallized wafers. Shortly after these two historic announcements, many other companies, including AMD and Motorola, announced their own copper plans. Copper, it seemed, was in; aluminum was out.

"Not so fast," says Intel's High, who believes aluminum is here to stay, at least for the foreseeable future. "By the year 2000, we'll be ready and able to deliver a GHz-rated processor using aluminum," he said. "But copper," he added, "will allow us to go even higher."

The big challenge right now, High says, is getting copper to a manufacturable level, and finding ways to produce copper chips at high volume with low cost. All the companies we spoke to agreed it would make sense to link the technology with a micron process change, since both require additional capital and hardware, but conceded it will take some time before any of this new equipment is completely stable, and the yields and outputs consistent.

Of the companies committed to copper development, all appear to be marching to the beat of their own drummer. For example, IBM is moving full-steam ahead with its proprietary plan (which it says is 20% to 30% less expensive than the current aluminum processes) and will probably be the first company to fully integrate copper metallization into the production process. In fact, the company is expected to release its first copper-based PowerPC chips, using a .18-micron process, early this fall. IBM has also started construction of its $700 million chip-development center in East Fishkill, NY, which will churn out copper chips beginning in 1999. These chips, IBM says, will contain up to 200 million transistors, about 30 times more than today's typical processors.

Intel meanwhile, is delaying its copper plans until it introduces its .13-micron process sometime in 2000 or 2001. In July, AMD and Motorola detailed plans of a strategic alliance that has Motorola licensing its current copper interconnect technology for use in AMD's .18-micron-based K7 product lines. AMD is also building a manufacturing plant in Dresden, Germany, that will produce copper-only chips.

"Copper interconnect technology is necessary to continue to increase processor speed and performance, and represents a key element in our 'Gigahertz 2000' goal," said AMD chairman and CEO Jerry Sanders. "Our first codeveloped logic technology... will enable us to produce GHz K7 processors in the year 2000."

Copper appears to be the panacea for creating smaller and more powerful chips. But will it become a marketable commodity that lets manufacturers differentiate their PC systems in retail? Probably not.

"Not many people walk into a retail store today asking whether the processor was built using a positive or negative resistor," said Intel's High. "All consumers should care about is what the chip does, how it performs, and how much it costs." He says we should leave the chip's physical properties up to the engineers and scientists.

So don't necessarily expect a "copper inside" sticker on your next PC, but don't be surprised if it's penny-powered.

to the pertinent details.

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HEADLINE	NEWS	DETAILS	QUOTE	OUR TAKE
New Palm PDA Specs Leaked	3Com's new Palm PDA, code-named Razor, is tentatively due out in November. It will be much slimmer than the current line and contain 4MB of memory.	Razor will also include a color LCD screen and is expected to retail for around $500. Expect some major price reductions in the current product lines.	3Com is keeping mum.	Thinner? More memory? Color? Can't wait!
Flat-Panel Interface Standard Proposed	The Japan Electronic Industry Development Association (JEIDA) has completed a first draft of its Digital Interface Standards For Monitors (DISM)	The proposed standard ditches support for IEEE 1394 and the VESA-approved Plug-and-Display format, but adds support for low-voltage differential signaling.	"This standardization effort is a response to the current lack of effective standards for the digital-format interface and display data," says a JEIDA press release.	If the spec is adopted by VESA and the major flat-panel vendors, great. But we don't need another competing standards war.

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iMAC Mania

Can it live up to the hype?

What's cuter and more colorful than a Volkswagen Beetle, but costs a lot less? Apple's new translucent marketing wonder, iMac, of course.

With ads purposely reminiscent of the 1984 launch of the Macintosh and the ubiquitous "Think Different" slogan, Apple is out to prove it still knows how to sell to consumers. It's also out to show it can still lay hype deeper than shag carpeting.

"We exceeded our best sales date in history by 75%," says Paul Ramirez, vice president of marketing for San Francisco Bay Area–based Computerware. Computerware, one of the few remaining Mac-only chains, sold an estimated 1,000 iMacs in just a few days. Analysts expect Apple to sell about 800,000 units in the next year.

At CompUSA, the only national chain carrying Apples, iMacs were moving off the shelf faster than pancakes at IHOP, prompting CompUSA CEO Jim Halpin to declare the iMac the biggest computer launch in CompUSA history.

The Macintosh community couldn't congregate 'round the iMac altar fast enough.

Dean McCarron, principal with Mercury Research, said he doesn't question the iMac's popularity, but outselling PCs is another fact. "It's highly unlikely, unrealistically unlikely, that in one month Apple would outship the PC market. That would equate to shipping 10 million units in one month."

While Apple is touting selling tens of thousands in a few days, McCarron says on average approximately 11,500 to 13,000 PCs are sold every hour. Worldwide, that works out to about 110,000 million PCs shipping this year. Analysts also wonder if Apple can keep the momentum going.

"I think it's going to be great for Apple for the next couple of quarters, but after that?" says Roger Kay, an analyst with International Data Corp.

Another nagging point is the support from software developers, many of whom have long forsaken Apple for the more fertile x86 grounds.

"Apple has a credibility problem with developers, so we will have to wait and see how things go. My position is pretty clear: If Apple supports OpenGL as its 3D API, id games will ship for the Mac."

—John Carmack, id Software

"It has been very sad to see developers who first developed on the Mac now say 'maybe' when questioned about Mac development," Ramirez says. Still, Apple's PR machine is citing hundreds of new titles, many of which have already been available on the PC for months, such as Eidos's *Tomb Raider 2* and Microsoft's *Age Of Empires*.

Among those still sitting on the fence is id Software's John Carmack. A virtual deity in the 3D-gaming world, Carmack says the iMac and the current MacOS is good for most people, but falls flat in 3D.

"They are making a lot of noise about being consumer-focused now, but Apple has a credibility problem with developers, so we will have to wait and see how things go," Carmack says. "My position is pretty clear: If Apple supports OpenGL as its 3D API, id games will ship for the Mac."

Look for our iMac review in the next issue of *Maximum PC*.

SPIN CYCLE

HEADLINE	NEWS	DETAILS	QUOTE	OUR TAKE
Intel Officially Launches New Celeron, Pentium II chips	It's official: Intel has started shipping volume of its latest chips: the 450MHz Pentium II, and the new, strangely named, 300A-MHz and 333A-MHz Celeron processors.	The "A" series Celerons include 128K of L2 cache, boosting overall system performance. Expect price reductions on AMD K6-2-equipped systems.	"PCs based on the new Intel Celeron processors deliver a great value and help open the door to computing for new PC users," said Sean Maloney, Intel's corporate vice president.	We dig the faster Pentium II, but we'll have to reserve judgement on the new Celeron until we've had a chance to test it.
Iomega Purchases Nomai	Iomega, überleader of the removable-drive market, has purchased a majority interest in French company Nomai after anticipating an intellectual-property victory in court.	Iomega and Nomai were locked in a legal battle over Nomai's alleged reverse engineering and violation of Iomega's patents and trademarks.	"We always firmly believed in the strength of our intellectual property. We are very pleased to settle this litigation." said James E. Sierk, Iomega's president and CEO	Less competition is bad for consumers, but maybe it's time for the market to agree on a unified removable-storage format.

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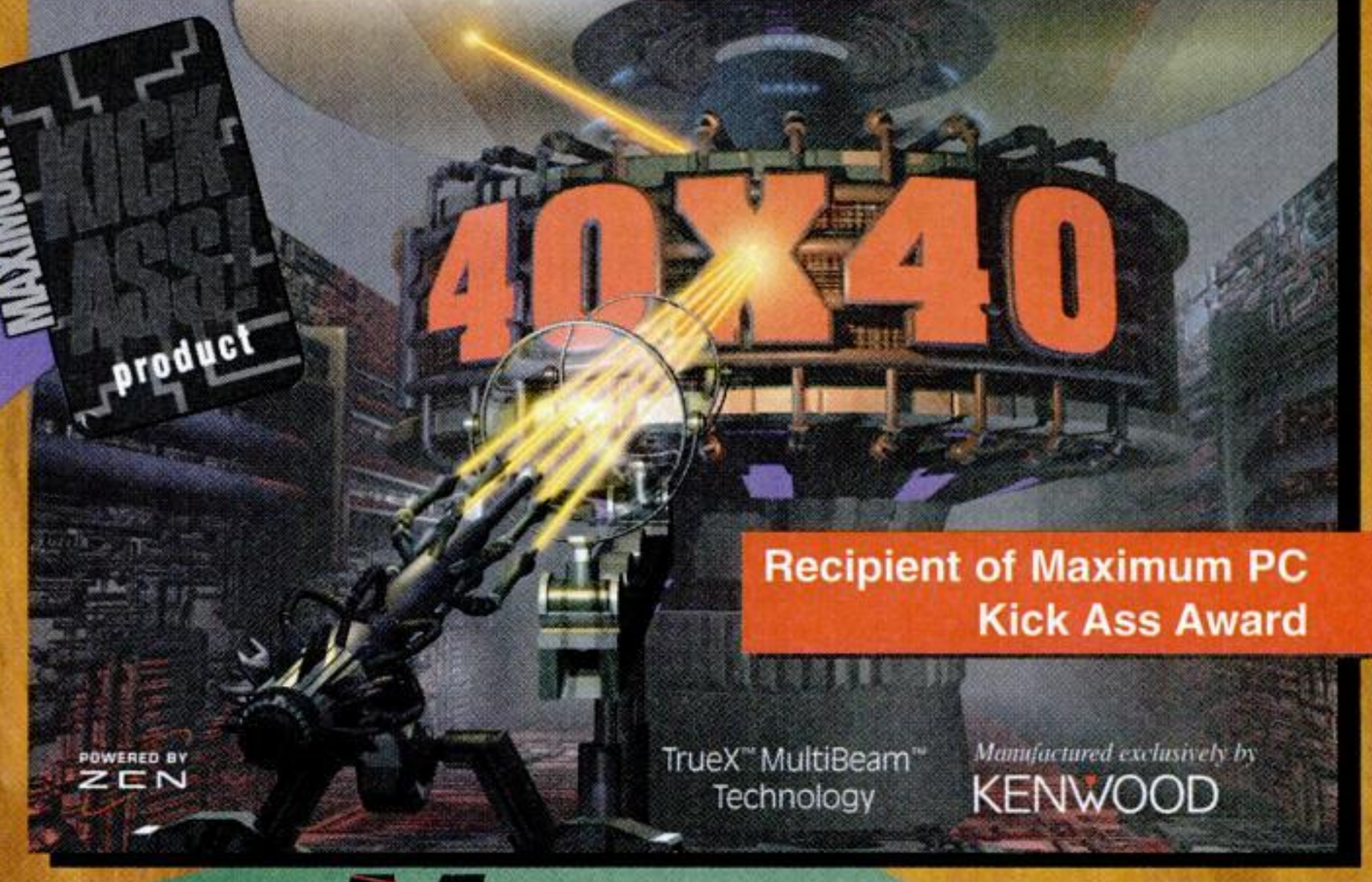

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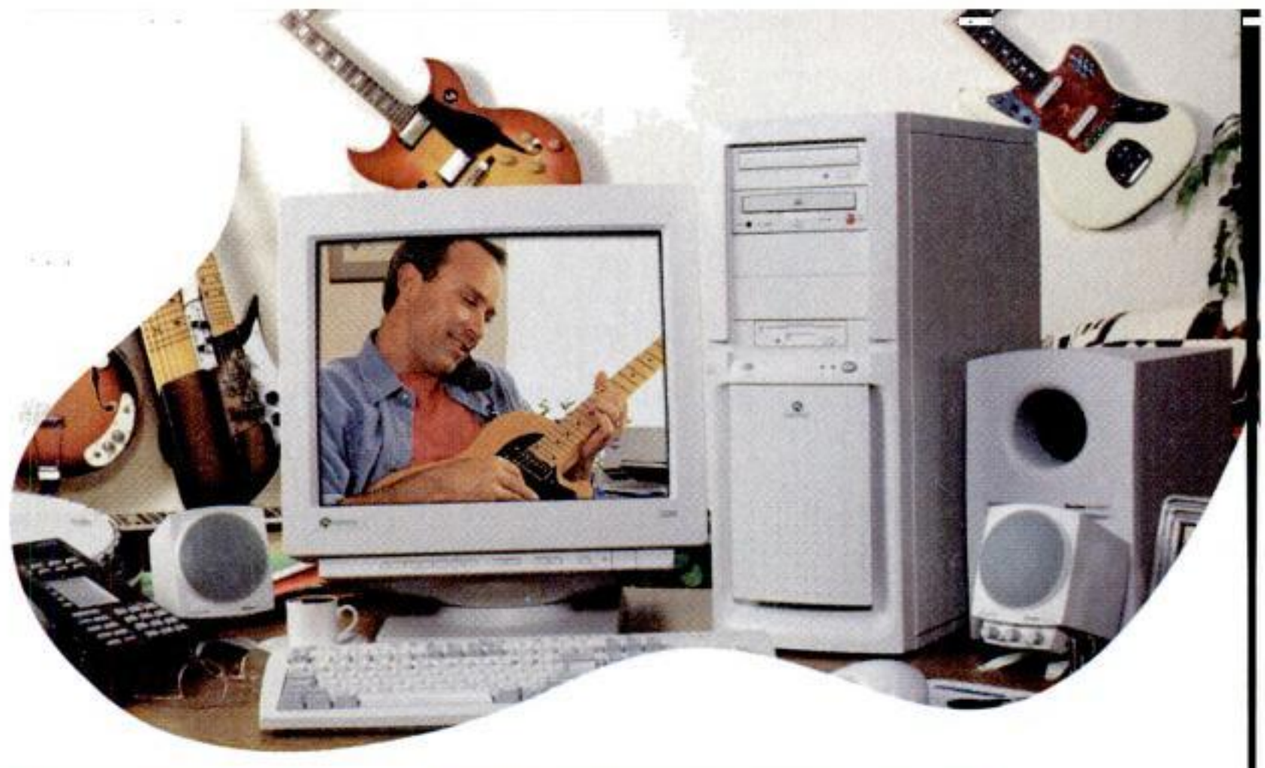

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You know the feeling. It sets in around the 5th or 6th pot. It's a bit beyond the traditional adrenaline rush. Well, that's what it feels like when you get to the 5th and 6th cylinders in Dead Reckoning. And with 9 more cylinders left to conquer, each featuring a more challenging alien opponent than the last, you'll be wired for days.

So don't put your plans for universal domination on the backburner. Check out the Dead Reckoning web site at www.deadreckoning.net now and look for this addictive game to hit store shelves near you soon.

Dead Reckoning is massive multi-player fun to the last drop

Who spiked

- 15 unique cylindrical battlefields
- Customize your game by selecting wingmen, ships and opponents
- Battle other players via internet, modem, IPX or direct connection
- Designed to take full advantage of 3D card acceleration

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AKA

RECKONING™

the coffee?

Warning: This game is served scorching **HOT.**

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K6

"As long as we stay close to their highest performing parts, Intel cannot hurt AMD without hurting themselves. That's the name of the game: Stay close, big volume, higher performance, execute flawlessly."

PROFILE

And he would be...?

Atiq Raza is AMD's Senior Vice President and Chief Technology Officer. He's the main man behind the company's successful launch of its K6-2 processor. Up next: the soon-to-be-released K6-3, and later, the K7, which he promises will be the "fastest microprocessor in the world." We'll see.

And I would know him from...?

You know those "Intel Inside" commercials? Well, if Atiq has his way, those commercials will soon give way to "AMD Inside" promo spots, especially if the sales of the K6-2 processor continue to climb.

And I would care because...?

Increased competition on the processor front means lower prices for the PCs you buy. And if AMD strategies pay off, PCs will become a lot more powerful, but cost a whole lot less. Who can argue with that sort of philosophy?

ossible

Maximum PC If Intel is the king of the CPU market, what is AMD?

Raza Intel is a monolith. They basically try to do everything themselves, and they're doing a pretty damn good job of it, but only because others can't, or don't, do it just as well. We can't compete with them by being a "little" Intel.

The difference between the two companies is that we're trying to work with partners so they gain more by working with us, rather than working with Intel. 3Dfx gains more working with us because we won't start producing a competing product, such as Intel's i740, and then try to get 3Dfx kicked out of the market. They have no such fear. We're trying to create a virtual alliance to be in a competitive position more powerful than if we tried to do everything ourselves.

Last winter, when we first launched our product, my biggest chipset provider met with our marketing and sales guys and said, "You guys are dead. Slot 1 is just going to wipe you out." But two days after the launch, the CEO called to tell me he has a huge backlog on Super 7 chipsets and he wants me to know he was now a total believer in the Super 7 initiative.

That is what makes us stronger. I alone am not as strong as I am when people and companies walk alongside me.

Maximum PC But that separation also leads to problems. When the K6-2 was released, there were a lot of chipset incompatibilities.

Raza That was the first time we actually carried an infrastructure. 99% of the chips that go into the Super 7 infrastructure are ours. We were getting chipset allies that were not complete believers and still worried whether Super 7 would be successful or not. Both CEOs of the two major chipset vendors sat across the table and said, "Am I going to be dead on this product? Will Slot 1 roll over me?" Both of them! And today they're very happy.

And motherboard companies were even more nervous! Evangelizing hardware vendors was more difficult than evangelizing software vendors. Software vendors could see through the selling proposition, and why it would be attractive. Hardware vendors could not.

Maximum PC Did you anticipate the hardware vendors' trepidation?

Raza No. I was also not anticipating that we would lose momentum in the fourth quarter because of manufacturing issues. We were on a sharp ramp and were experiencing excellent demand for our product, but then we hit a huge manufacturing stumble and lost credibility across the industry.

That loss of credibility rolled over into our ability to convince the motherboard vendors and the chipset vendors to start working with us more aggressively on Super 7. They basically said, "Show me a PC OEM who is going to give me an order, and I'll start working with you to make our motherboards and chipsets work." We're the ones who provide the confidence in the infrastructure, proving they should continue to work with us.

Now we have total support, but the confidence of the infrastructure providers rests on our success along the way. It jeopardized the quality of the launch, but thankfully we were able to work through it.

Maximum PC So you don't anticipate more confidence problems moving forward?

Raza Volume is a wonderful thing. Vendors now come to us and say, "Let's have a plan early; let's start working early; and let's start the validation cycle early."

Maximum PC Why doesn't AMD just get into the core-logic chipset business?

Raza Our approach is to build partnerships. When Intel believes something is critical, it just sucks it in and does it itself. To take Intel on, that approach will cause us to run out of energy, bandwidth, and engineering capability. Each time Intel does this, it disenfranchises the previous providers

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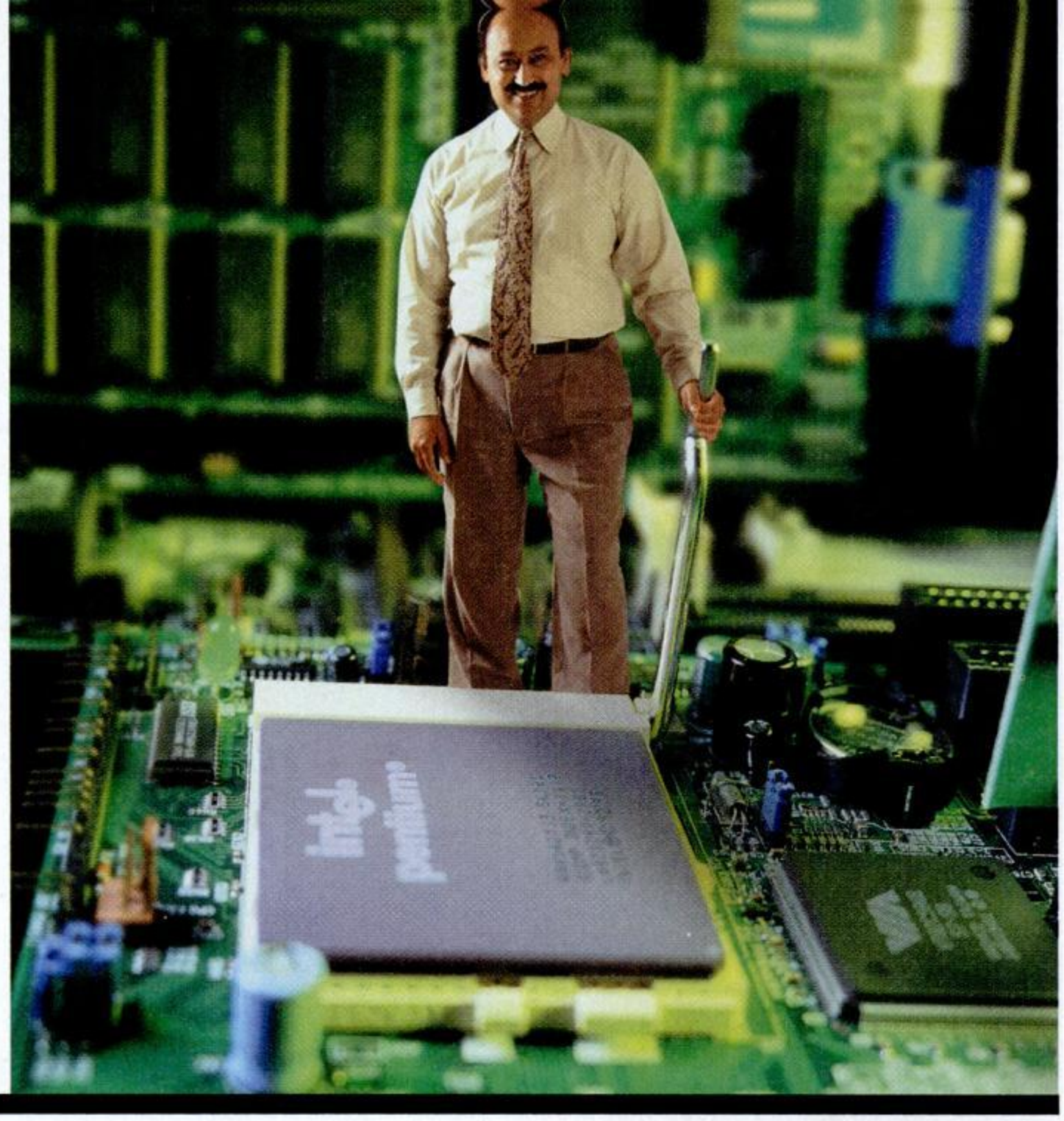

driver and the graphics adapter. But that's common to virtually every application. If he is using the library routines in DirectX, then he gets an incremental benefit.

Maximum PC So developers don't lose anything by supporting 3DNow! through DirectX?

Raza As a software developer, you have a choice to use your own libraries—say for lighting and shading—or use the DirectX libraries. There's no difference in terms of the level of support.

Maximum PC In early 1999, developers will have to decide whether to support Intel's second generation of MMX with Katmai. How will this decision affect AMD and 3DNow!?

Raza Katmai doesn't affect 3DNow!, but it does turn the focus of the industry on Intel. Our agenda at that time is to make sure our message doesn't get lost. We were there first, we have momentum, and we have a significant installed base. We'll have over 10 million units out there with 3D capability and a huge amount of software.

"We were on a sharp ramp and experiencing manufacturing stumble and we lost credibility

of chipsets, graphics controllers, or motherboards. Our alliances create a virtual support structure that is just as strong as or, in some cases, stronger than Intel's.

The chipset companies want to work with us, but if there's a risk that they aren't moving fast enough, we'll do our own chipset. For the K7 we have created our own chipset. However, we will license the chipset technology to external companies in order to build their businesses and keep them strong as external providers of the infrastructure that goes into the PC.

Maximum PC What does AMD's evangelism program entail?

Raza The work we do with the PC OEMs results in combined advertisements and combined coverage in the channel. And that has been extremely effective. We also have programs where we've bundled key software that shows 3DNow!'s dramatic impact.

The other front is working with the software developers. We have provided them with a very sophisticated set of tools. We are in beta right now with a new tool—a performance analyzer—which will have the combined intelligence of our best engineers. This engine that will take the code, run it, and give very detailed feedback to the developers on how they can make improvements.

The team we have is not large, but is extremely capable.

Maximum PC How much of that "developer support" have you had to outright buy?

Raza None, unless you call bundling agreements buying developer support. Developers said, "Don't give me money. If I could be bought, I'd be writing this stuff for Sun." They're not going to make money just by getting a million dollars from us. They might make something that doesn't sell and go out of business. Show them a volume roadmap, a means to achieve similar volumes, and they'll want to work with you.

We may not make money on those bundling agreements, but they do convey the full impact of the performance gain.

Maximum PC Are there features developers can take advantage of if they write directly for 3DNow! instead of DirectX?

Raza 3DNow! can be supported either directly or through DirectX. There's a certain amount of help a developer will need from DirectX just to be able to work with the

Maximum PC Exactly how much software will support 3DNow! at that time?

Raza It's hard to even put numbers on how much software is already working with 3DNow!. However, we are not standing still. We won't say, "3D is done now; let's wait..." and let Katmai run past us. No way. We will do something—not immediately—that will further enhance our 3D instructions.

Maximum PC Won't developers just say, "Hey, Intel's got more money and muscle than AMD, so we'll support Katmai instead?"

Raza When Intel introduced its graphics chip—the i740—people didn't abandon ATI, nVidia, S3, and all the established graphics chips, to run to Intel. They stuck with the chips that packaged value to the end users.

Software developers are interested in installed base. And by the end of next year, ours will be pretty huge, and it will be ahead of Katmai's installed base.

And from what we understand, Intel will be targeting Katmai at the high-end of the processor performance. We'll be taking 3DNow! from top-to-bottom.

Maximum PC Any plans to license Intel's Katmai instructions?

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Raza We don't need to. We have a blanket cross-license with Intel for all its patents. So if we choose to be compatible with Katmai, we can be. There's nothing to stop us.

Maximum PC Based on what you know about Katmai, are there things Intel's done that you wish you'd done with 3DNow!?

Raza I don't know a lot about Katmai, so the answer now is no. There's nothing that I've seen that caused me to say, "Oh my God, I should have done that!" From descriptions I've read on the web and from various informed sources, some things are different and some things are very similar. In terms of software performance, I think the performance will be largely indistinguishable.

Of course, Intel has a much bigger software organization and can jigger up some Intel media benchmark kind of shit—pardon the French—and come up with numbers that look big and make us look small. This I can't stop them from doing.

Maximum PC You're not expecting any major defections then?

Raza I don't see any defections at all because, with an installed base of 10 million units, the software developers are very satisfied. In fact, we have more installed base than any single graphics-adapter card. Software vendors are always anxious to support 3Dfx's and nVidia's relatively smaller installed bases. We offer a much bigger opportunity.

Maximum PC Wait a minute, ATI has sold some 22 million chips...

Raza Look at just the 3D rendering chips from ATI and it's a much smaller number. Not all of their chips are applicable.

Maximum PC A while back, you said you expected "fun" things to happen toward the second half of 1998. Are you having fun yet?

Raza Yes, definitely. We had K6, transitioned to K6-2, and had major frequency transitions, including 350MHz, despite endless industry reports from Ashok Kumar [an analyst with Piper Jaffray] saying we couldn't.

Maximum PC Is the 350MHz K6-2 now in production?

Raza Yes. It's rolling out right now.

Maximum PC What then?

Raza This pace will continue. Next is K6-3, which will be followed-up by K7.

Maximum PC So the K6-3 is coming out first quarter of next year?

Raza That's when you'll see it in systems everywhere. It will actually start shipping earlier. It will begin production in Q4. We've had samples for a while now.

Maximum PC Are you expecting any production snafus this year?

Raza I'm not expecting them. I didn't expect them last year either! But this year, since we had the production snafus, I can say with confidence that right now it's looking like a well-oiled machine, knock on wood of course.

Maximum PC We've heard that when you plug the K6-3 into the current motherboards the L2 cache on the motherboard will then become L3 cache. True?

Raza That is true.

Maximum PC How have you done that? Has it necessitated a whole re-engineering process on your end?

Raza Inside the microprocessor, yes. In the days of NextGen, the precursor of the K6 had a backside cache. When we decided to go into the Pentium socket, we could not accommodate the backside cache outside the chip. When we got to a point where the technology and our design methodology accommodated the backside cache, we had a backside L2. But we had to have a hierarchy of caching, where the external cache became a third-level cache. So yes, we put in the design capability and the intelligence in the microprocessor to enable the outside cache, which is historically called the second-level cache, act as the third level of cache.

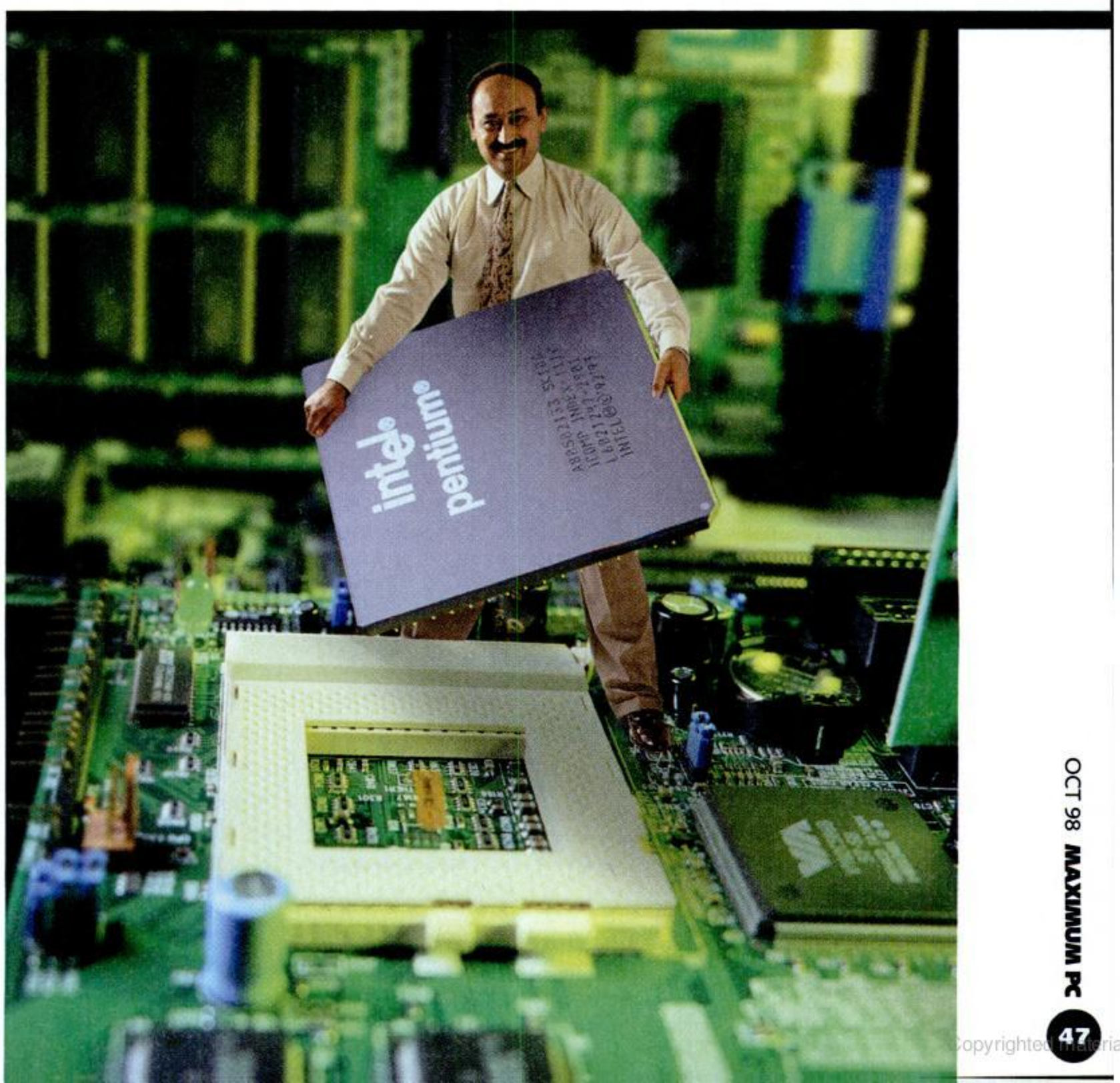
Maximum PC Besides the integrated L2 cache, what's the difference between K6-2 and K6-3?

Raza There are some improvements we made to the communication pipelines between the 3D unit inside K6-3 and the graphics chip.

Maximum PC And what does that equate to in terms of performance?

Raza In *Quake*, or similar games with 3D performance, it will be a huge, huge benefit. At least 10% over what the K6-2 is doing today at the same frequency.

excellent demand, but then we hit a huge across the industry."



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Maximum PC How backward-compatible will the K6-3 be with current motherboards and core-logic chipsets that support the K6-2?

Raza It's completely backward-compatible with current chipsets and motherboards. There are no issues in terms of any modifications required on the chipsets and motherboards.

Maximum PC What can you tell us about the K7?

Raza My goal is to have the fastest microprocessor in the world with the K7.

Maximum PC Pretty lofty goal.

Raza We're actually closing the gap on Intel in frequency. Intel doesn't stand still, but it's not perfect either.

For the most part, the K7 will be a fully three-way superscalar. The 3D pipeline is a 128-bit wide pipeline, and it too will include backward compatibility with the 3D extensions. The floating-point and the 3D performance is just awesome. It's a vector engine, so you can process more floating-point arithmetic in parallel.

Maximum PC The floating point on the K6-2 is notorious. Why haven't you been able to beat Intel's floating-point performance?

Raza We will. The floating point in the K6-2—the classic IEEE-built precision floating point—is not of the quality I would like it to be. We had a choice to improve its performance and bring it up to par with Intel or launch our 3D technology. 3D basically becomes a vector floating-point engine for graphics. So the value we would have gotten with the 3D technology covered 99.9% of what the floating point was used for. That's why we focused on it.

With K7, we'll make no apologies. Double-precision/single-precision, 3D technology extensions as well as double-precision classical IEEE floating point. Again, the K7 will be the highest performance processor, in both integer and floating point.

We intended K7 to be a server product, and to take advantage of the server infrastructure provided by Alpha. But at the same time, having a cost structure and capability that would make it a compelling consumer product and a compelling commercial product too.

Maximum PC What speeds will K7 launch at?

Raza Higher than 500MHz.

Maximum PC What about bus speeds?

Raza The K7 will have up to a 200MHz data transfer rate. But we can go above that.

Maximum PC K7 is also going to use Slot A?

Overclocking: The Right Way

Maximum PC You've been on the record as saying overclocking is bad, yet you support KryoTech selling its Cool K6-2 450, essentially an overclocked K6-2 machine. Isn't this blatantly hypocritical?

Raza No, especially considering KryoTech is doing it right.

Maximum PC So there's a right and wrong way to overclock?

Raza That is correct. The Cool K6-2 450 isn't an overclocked one I'd say. It's more of a complete engineering solution. Taking apart and running a CPU at a higher frequency than it's specified to run at is overclocking. But taking one apart and looking at what frequency it should run at when the working conditions with the right temperature and the right environment and the right heat flow is legit.

Heck, I'm hoping to buy a KryoTech machine for myself.

Raza K7 will be Slot A, which is physically compatible, but not electrically compatible with Slot 1.

Maximum PC So what makes Slot A better than Slot 1 or Slot 2?

Raza The protocol allows it to run at a very high bandwidth. The frequency is going to be in the hundreds of MHz. And the transfer of information is unimpeded by the way the connections of wires go—of address and data going back and forth.

Graphics will definitely get a dramatic performance boost, not just from having a very powerful 3D engine, but having very high communication bandwidth between the 3D engines and the graphics controller.

Maximum PC Will Slot A fix the problem of the processor falling out of the slot?

Raza It won't fix the problem completely. Intel has made improvements. They've put in posts, they've put in clamps, they've put a chip holder... all kinds of things. Some of those things we will use, and part of the reason we make it mechanically compatible is because there's an industry out there benefiting from all these things.

Maximum PC Will Slot A be the end of Socket 7?

Raza Not really. Socket 7 is a fine way to deliver performance within the constraints of the systems up to the year 2000. I originally thought it would last only until 1999, but it looks like it will now last till 2000.

Beyond that, there's a need for things that are more easily accomplished on a slot-like solution, such as backside caches and high-speed buses. All the high-speed interactions reside on one small board, which you can make complex.

Maximum PC Would AMD license Slot 1 if Intel offered it, once Slot 2 is seeded?

Raza Well, I shouldn't say we're not interested, but we're not going to have any products committed to that direction unless we see some market reason for doing so. The Slot A train has left the station and is zooming forward.

Besides, Slot 1 is dated. It doesn't serve the need of what we're trying to accomplish with K7. The performance needs are too high at both at the processor level and the system level.

Maximum PC Will the K7 chip be a .18-micron chip?

Raza There will be a .18-micron K7, but when K7 launches it will still be in .25 micron.

As we move forward to .18-micron technology, the development is going to be shared jointly between AMD and Motorola.

Maximum PC Motorola? What happened to IBM? You made such a big deal about the fab agreement with IBM and now you're just walking away?

Raza Well I wouldn't say, "we made a big deal" about working with IBM. We had an agreement with IBM, which was a .25-micron foundry agreement. But moving forward, the final agreement has been signed with Motorola.

Maximum PC Why go with Motorola?

Raza Motorola was interested not only in our logic technology, but also on developing a technology that would bring together on a single process flash technology and logic. AMD has been a leader in flash technology. Between AMD and Fujitsu, which use the same manufacturing and the same technology, we have more market share than Intel.

Maximum PC AMD was working on its own copper technology. Now you're committed to developing copper technology with Motorola. Is your original work dead now?

Raza No, not dead. We are just taking the resource and pooling it with Motorola's resources. We had a small number of people working on it; Motorola had a large number of people working on it.

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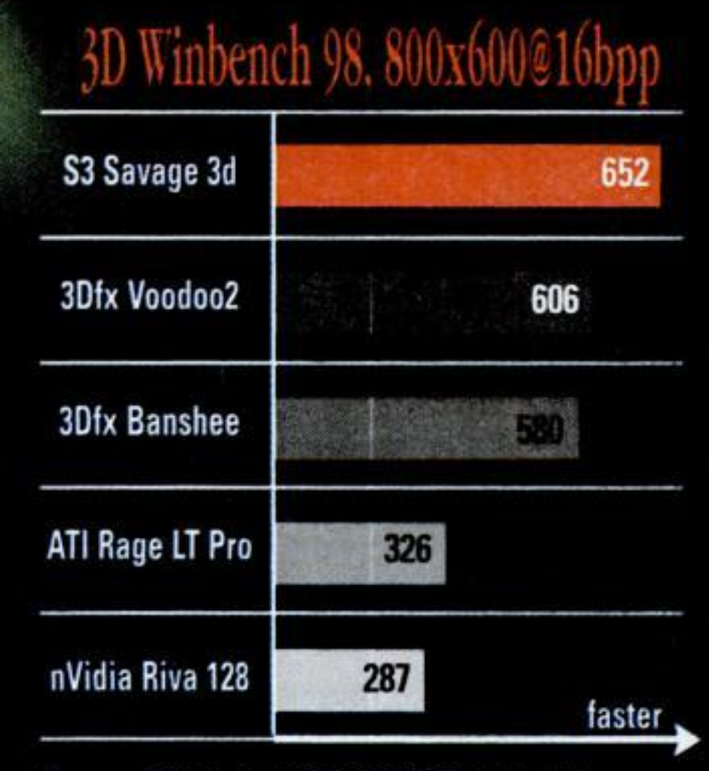

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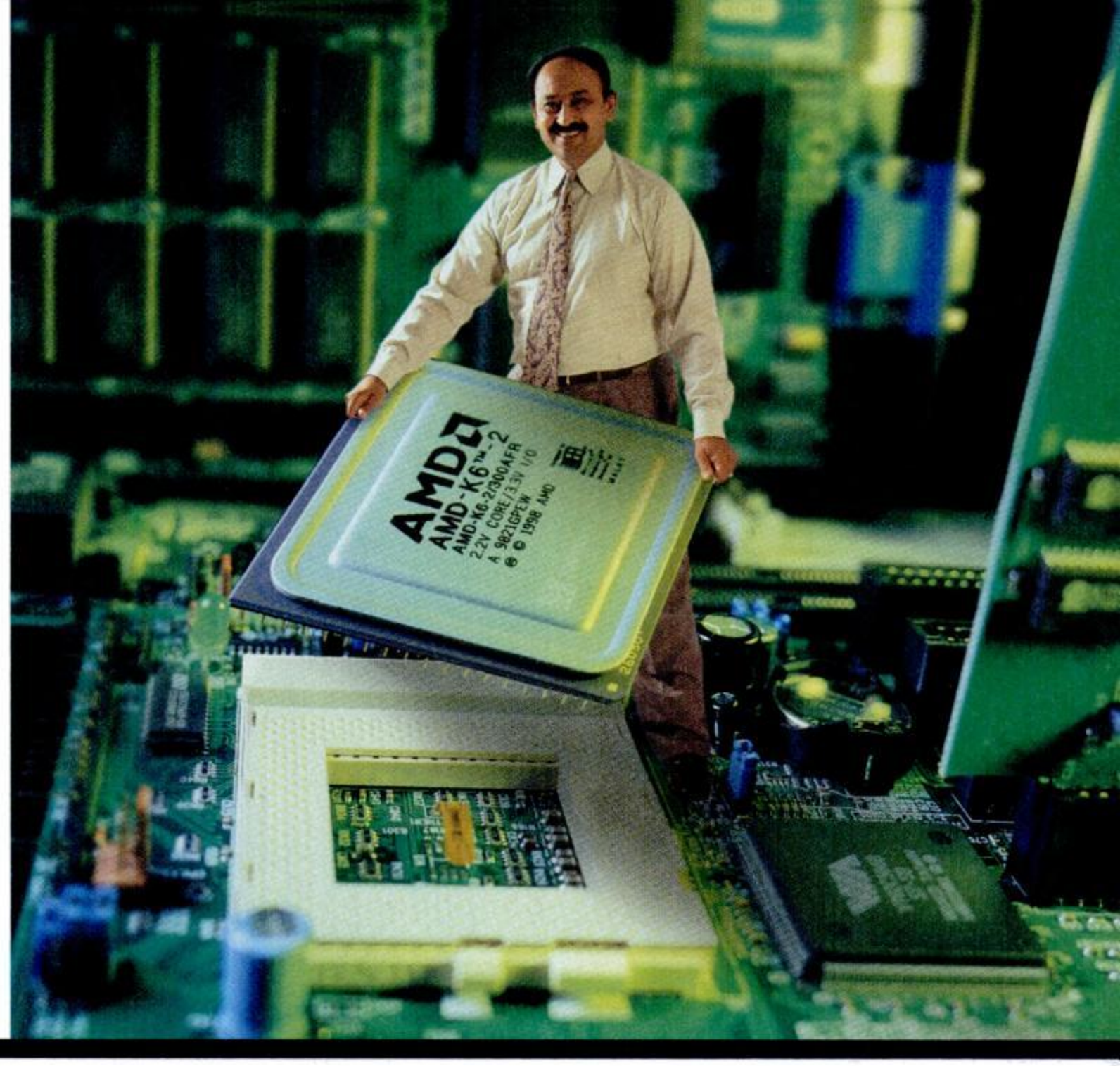

Maximum PC Why is copper so gosh darn important?

Raza It allows the best combination of low capacitance and low resistance available for signals to travel. So it allows signals to move faster to the interconnect, going from .25 to .18, the delay to the connections is becoming a huge component of the total delay. So if you use copper instead of aluminum, you have two ways to take advantage of it: one, the resistance load, or you can make the copper thinner—and that reduces the capacitance inside the metal system. That's a big deal. That's going to become the critical path, .25 and beyond.

As we move forward in the evolution of technology, the delay that occurs on a microprocessor occurs as a result of the delays from the transistors and the interconnect, which is made out of aluminum.

An interconnect has a cross-section that is rectangular. In your mind's eye, think of a rectangle and a bar with a rectangular

"I think Intel's practices are far more egregious than Microsoft's. It has used every capability that it has to utilize it's monopolistic control over the market."

cross-section. With today's technology, that rectangle will have a width that is wider than the height. Moving forward, because of the density requirements, the width will become smaller than the height. So rather than having a flat bar, the interconnect will begin to look like a wall. When it looks like a wall, it causes interaction horizontally between interconnects running side by side. Copper provides a means to reduce the horizontal interaction between the interconnect, and accelerate the delays through the interconnects.

In other words, the chip can run faster. That's the only reason consumers should care.

Maximum PC How much of a performance increase are you realistically expecting once you move to copper?

Raza One to two frequency bins. So if we're at 500MHz, it will give us a 550MHz and a 600MHz.

Maximum PC Is there a cost benefit to using copper?

Raza There is. Not substantially, but enough to make a difference in our favor.

Maximum PC Is the K7 going to be copper-based?

Raza There will be K7 with copper technology; there will be K7 with aluminum technology.

Maximum PC Is there a K8?

Raza It's under development. There is a spec, but it's too early to share it.

Maximum PC How about this: Will the K8 be AMD's first GHz chip?

Raza [laughs] Ahhh, I don't know! Maybe we'll get to a GHz before that!

Maximum PC The K6-2 is doing relatively well for the company. But Intel still has a lock on mindshare. Just how important is mindshare to your success?

Raza We have to earn it, and you earn mindshare by continuing the success that we're getting with K6-2, but having it translated to corporate success also. As AMD becomes profitable and sustainably profitable and brings out new products that have market success, then we will get incremental mindshare. In fact, we were getting mindshare in the early days of K6, but we stumbled and lost it.

Maximum PC Can AMD continue to compete with Intel's pricing strategies? At what point will AMD be driven completely out of business?

Raza When AMD falls behind on the frequency ladder. As long as we close the gap with Intel and stay as close to the highest performing parts as possible, Intel cannot hurt AMD without hurting themselves. That's the name of the game: stay close, big volume, higher performance, execute flawlessly.

Maximum PC But in order to make a profit, you need to have a $100 average selling price. Will you forever maintain a price that's at least 25% below Intel's?

Raza No. That's entirely dependent on what kind of products I offer. If my products become very compelling, then the relative discount will depend upon how attractive the product is. We won't have a fixed discount at all times moving forward, especially when we have better products than Intel. The $100 selling price won't be sustainable if we fall

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behind in frequency. The smaller the gap between AMD and Intel, the more the $100 or $100+ selling point is sustainable.

Intel also has a selling price average. That selling price average is somewhere over $200. We have to just keep in mind that that comes from the entire range of products, from their highest end to their lowest end. Their lowest end is where the prices are cut; the highest end is not where the prices are cut. We have to just make sure that we have a distribution closer to their highest end so it becomes very difficult for them to cut prices aggressively.

Maximum PC Some have accused Intel's price cutting of basically dumping product. Do you agree?

Raza No. They have been aggressive because the competition has forced them to be aggressive in price cutting, but that has been accompanied by their attempts to move faster. Both of us have moved faster and have had to fight. When we fell behind, we suffered detriment of not being able to get to the $100 average selling price. As we close the gap, it will become easier.

Maximum PC Do you think Intel's monopolistic?

Raza Of course, it is a monopoly. It owns the majority of the marketplace overwhelmingly. And it has used every capability that it has to utilize its monopolistic control over the market. So it's very difficult in that sense to compete with Intel because you're not just competing with a product—you're competing with an organizational philosophy and a marketing philosophy that takes advantage of their monopoly position.

Intel doesn't reveal anything to create a level playing field. I'll even give you an example. Intel right now has a firmware hub under development and has given out the spec to the whole world under nondisclosure. A fundamental part of the PC platform standard and it's been distributed under nondisclosure! Why? This is a violation of every antitrust law!

Here's another. After Intel licensed MMX to AMD, they went and told ISVs not to work with AMD because they had signed nondisclosures. We had a license, an open license, a legal license from Intel on MMX. We had the right to work with ISVs, but ISVs said: "Intel lawyers told us we can't work with anybody because we signed this nondisclosure." This is a totally monopolistic trade practice.

Maximum PC Is that going to come up on the FTC investigation?

Raza I hope so because I think Intel's practices are far, far more egregious than Microsoft's.

Maximum PC You've previously stated that Intel wasn't sensitive to their customers needs. Does this hold true today?

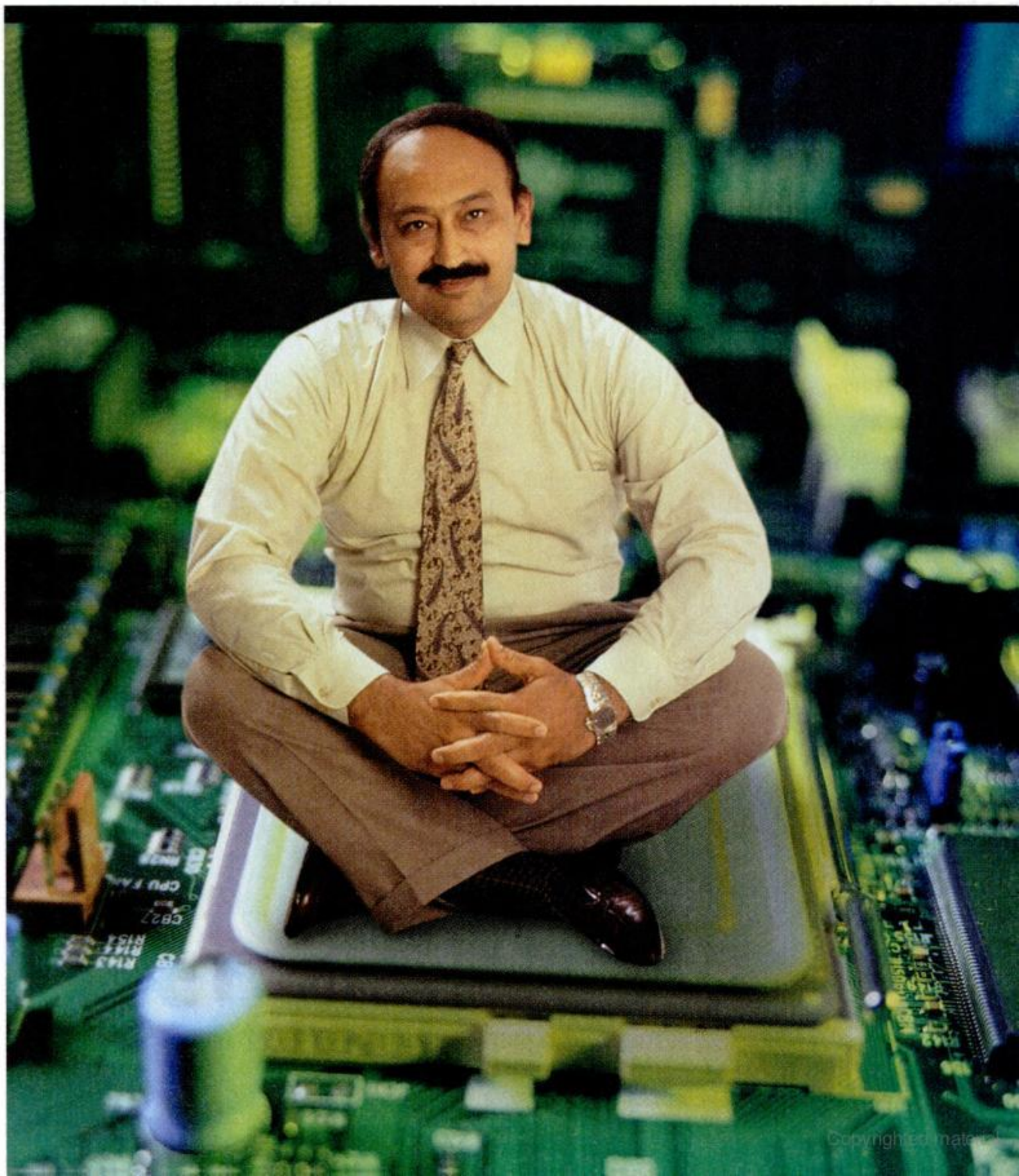
Raza I still believe it holds true. There's an interesting perspective that a lot of people associate Intel, their arrogance, and their abrasive style, with their success. I think that is one of our advantages against Intel. Even when they go and try to be more customer sensitive, it's more like a pretend friendship than anything else. It's like: "Come in and I'll put my arm around you and if you don't go with me, I'll just kick you." If somebody tells you Intel now has developed a customer-sensitive and friendly culture, he's lying!

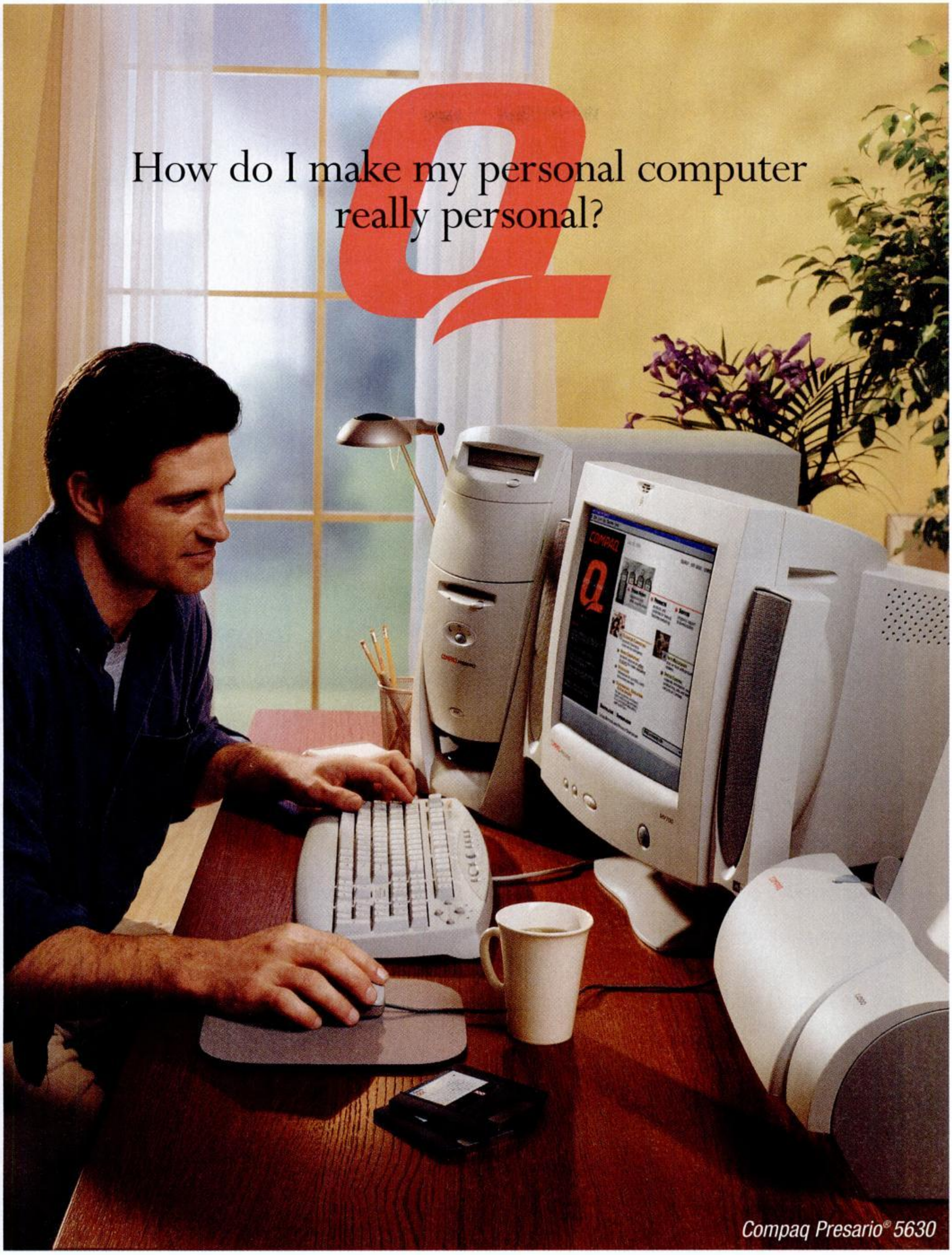
Maximum PC Andy Grove sits in a cubicle: What is AMD's corporate culture like?

Raza First off, Andy Grove sits in a really nice, huge cubicle. It may be a cubicle, but it's as comfortable as any office anywhere.

AMD's culture is hard to characterize. But we are definitely customer-friendly. It's also very friendly within the company, it is hard-work intensive, it is driven by a competitive urge, it is cohesiveness throughout the organizational structure, and it is driven by the mission to succeed against all odds. ✹

"The floating point in the K6-2 is not of the quality I would like it to be. With K7, we'll make no apologies."





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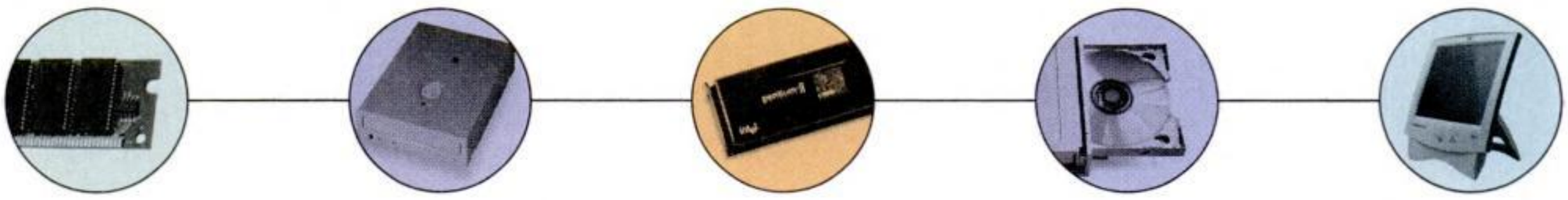

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intel inside pentium® II PROCESSOR

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- 10 Mbps Ethernet port, Cable Modem Ready
- Microsoft® Office 97 Small Business Edition
- Microsoft Windows®98
- Presario MV 700 17" Monitor (15.9" VIA)

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- 64 MB SyncDRAM expandable to 384 MB
- 56K ITU v.90 Modem[3]
- Digital Creativity Imaging Center w/1394
- 2X AGP Graphics w/8 MB SGRAM
- 10 Mbps Ethernet port, Cable Modem Ready
- Microsoft Office 97 Small Business Edition
- Microsoft Windows98
- Presario MV 700 17" Monitor (15.9" VIA)

Personalize it by choosing:
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- Smart Lilon Battery
- 512 KB L2 Pipeline Burst Cache
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$1,799

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- 56K ITU v.90 Modem[3]
- 2X AGP Graphics w/8 MB SGRAM
- 10 Mbps Ethernet port, Cable Modem Ready
- Microsoft Office 97 Small Business Edition
- Microsoft Windows98
- Presario MV 700 17" Monitor (15.9" VIA)

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- 2nd-Generation DVD-ROM Drive[4]: Add $100
- Digital Creativity Imaging Center w/1394: Add $49

Compaq Presario 5600-333

$1,799
-$100 mail-in rebate[1]

$1,699

Base price includes:
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- 8.0 GB UltraDMA Hard Drive[6]
- 32X Max CD-ROM Drive[2]
- 64 MB SyncDRAM expandable to 384 MB
- 56K ITU v.90 Modem[3]
- 2X AGP Graphics w/4 MB SGRAM
- 10 Mbps Ethernet port, Cable Modem Ready
- Microsoft Office 97 Small Business Edition
- Microsoft Windows98
- Presario MV 700 17" Monitor (15.9" VIA)

Personalize it by choosing:
- 128 MB SyncDRAM: Add $200
- 2nd-Generation DVD-ROM Drive[4]: Add $100
- 8 MB VRAM: Add $29

Compaq Presario 1600-233S

Fully loaded, all-in-one design

$2,499

Base price includes:
- Intel Pentium II Processor, 233 MHz
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- 64 MB SyncDRAM expandable to 96 MB
- 4.0 GB Hard Drive[6]
- 24X Max CD-ROM Drive[5]
- 56K ITU v.90 Modem[3]
- Smart Lilon Battery
- 512 KB L2 Pipeline Burst Cache
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Compaq Presario FP 500

$899

- 14.1" Viewable TFT Active Matrix Display
- XGA 1024 x 768 Resolution
- Detachable JBL Pro Speakers (not shown above)
- Integrated Telex® Microphone
- Digital Flat Panel (DFP) Interface
- Energy Star Compliant
- Universal Power Supply

Compaq Presario IJ 200

$129.99

- Single-head thermal inkjet technology
- Up to 600 x 600 DPI resolution
- Sharp text and sharp color prints
- Print Speeds:
  Up to 3 1/2 pages per minute black
  Up to 1 1/2 pages per minute color
- Paper tray holds up to 30 sheets

Compaq Presario IJ 900

$299.99

- Dual-head thermal inkjet technology
- High-speed, high-quality text and graphics, even on plain paper
- Up to 1200 x 1200 DPI resolution
- Laser-quality text and sharp color prints.
- Print Speeds:
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  Up to 4 pages per minute color

Compaq Presario 5140

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-$100 mail-in rebate[1]

$1,999 (with Monitor)

- Intel® Pentium® II Processor, 400 MHz
- 8.0 GB UltraDMA Hard Drive[6]
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- 100 MB Iomega Zip Built-in™ Drive
- 56K ITU v.90 Modem[3]
- 10 Mbps Ethernet port, Cable Modem Ready
- 2X AGP Graphics w/4 MB SGRAM
- Creativity Action Center 2 USB/1 Game Port
- Aureal A3D® Interactive 360° Positional Sound
- Easy Access Internet Keyboard
- Microsoft® Windows®98
- Presario MV 700 17" Monitor (15.9" VIA)

Compaq Presario 5030

$1,749
-$100 mail-in rebate[1]

$1,649 (with Monitor)

- Intel Pentium II Processor, 300 MHz
- 8.0 GB UltraDMA Hard Drive[6]
- 100 MB Iomega Zip Built-in™ drive
- 64 MB SyncDRAM expandable to 256 MB
- 56K ITU v.90 Modem[3]
- 32X Max CD-ROM Drive[2]
- Creativity Action Center 2 USB/1 Game Port
- 2X AGP Graphics w/2 MB SGRAM
- Aureal A3D Interactive Sound
- Easy Access Internet Keyboard
- Microsoft Windows98
- Presario MV 700 17" Monitor (15.9" VIA)

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[No-Compromise] NOTEBOOKS

Five **Supermodels**... and One Perfect 10

Plenty of beauty, but no brains. Slim figure, but no muscles. Great style, but no depth.

The perfect notebook is an elusive creature, but it does exist.

Modern mobile supermodels now come with everything you've come to expect from desktop systems. Pentium II power, 3D acceleration, DVD-ROM. It's all there in a svelte size 6.

No more compromises.

We've rounded up five notebooks that redefine mobile computing. Four are loaded with a new breed of power parts, while one packs PC performance with only PDA poundage. Not all these notebooks perform as sweet as they look on paper, so if you still can't find what you're looking for by page 63, turn the page for essential tips on buying the notebook of your dreams.

You *can* have it all.

FASHION PHOTOGRAPHY BY NANCY ERICSSON/PRODUCT PHOTOGRAPHY BY AARON LAUER

by **Bryan Del Rizzo**

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Dell **Inspiron** 7000 D300LT

King of Kings

MAXIMUM PC KICK ASS! product

The Inspiron has it all. Everything. Its component list reads like a PC freak's spending spree: 300MHz mobile Pentium II, 64MB of SDRAM, 8GB hard drive, and an integrated 56Kbps modem. Add in an 8MB ATI Rage LT Pro video chipset (dig the memory amount!), a superlarge 15-inch TFT display, and a DVD-ROM drive with hardware MPEG-2 decoding, and you've got a notebook that doubles as a gaming machine and personal theater.

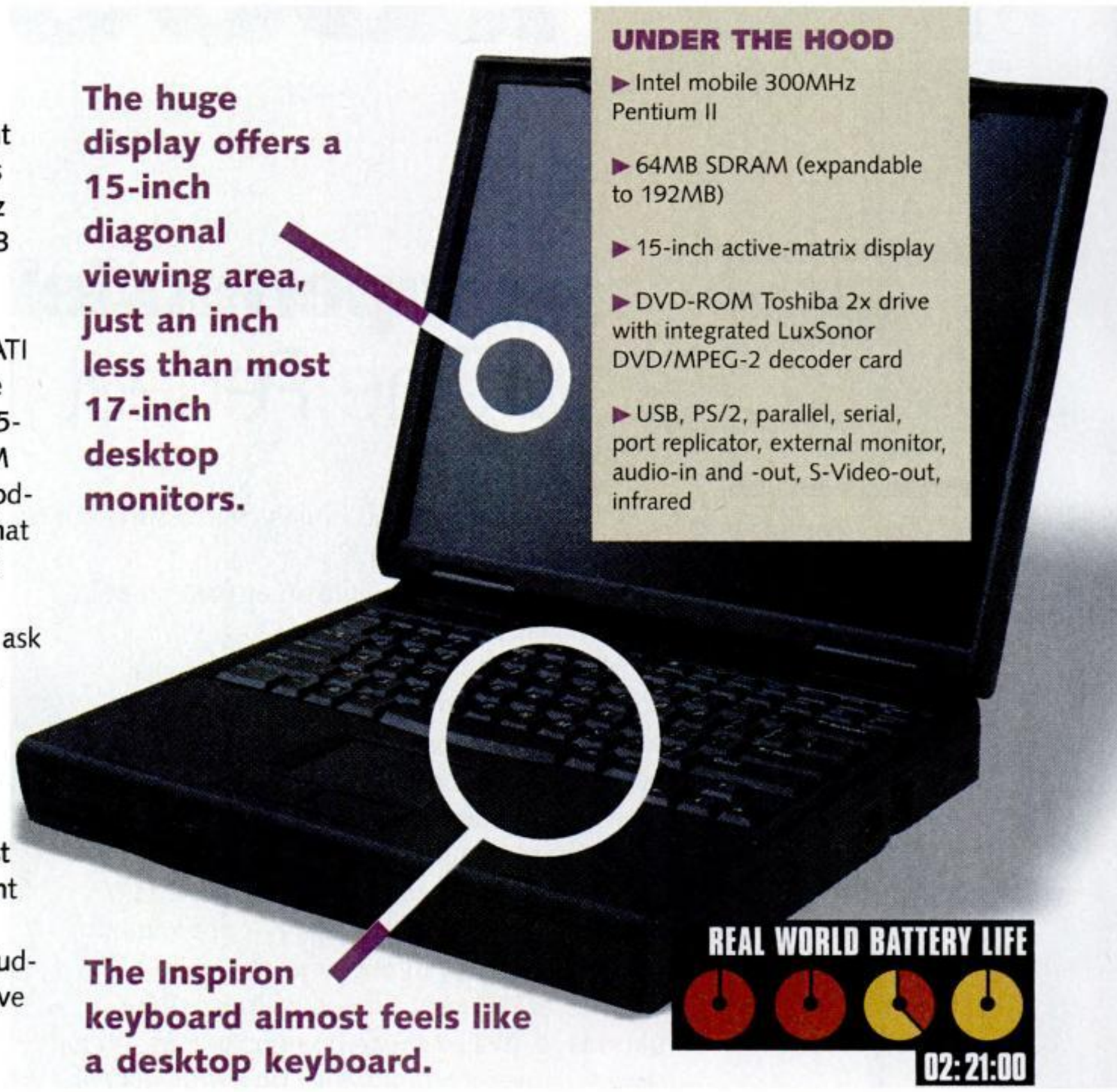
What more could you possibly ask for? With the exception of, say, a gameport, not much. Of course, hardware specs don't mean diddly if the performance isn't up to snuff, but the Inspiron stands proud. In the benchmarks that test basic system speed and component integration, the notebook scored well. Individual components—including the 2x Toshiba DVD-ROM drive and 8GB IBM hard drive—scored even better. If it's speed you're looking for, it doesn't get much faster than the Inspiron.

But wait, there's more! The Rage LT Pro is actually a 2x AGP, 64-bit graphics accelerator, with support for Direct3D and DVD. 3D-rendering quality looked stellar, and DVD playback was smooth as silk, with nary an artifact to muddy the display. And while the Rage LT Pro's 3D capabilities can't compete against a desktop-only Voodoo², we were still mighty impressed with its performance in *GLQuake*: 24fps at 640x480, and 17fps at 800x600.

The Inspiron may be a mammoth, shoulder-wrecking notebook, but don't let its 9 lb.-plus weight deter you. With this much power in your lap, co-workers and acquaintances will be jostling each other for a look-see. And thanks to your newly defined traps and lats, you'll look mahvvvellousss lugging the Inspiron around the nation's airports, too.

The Inspiron is truly an inspiration.

The huge display offers a 15-inch diagonal viewing area, just an inch less than most 17-inch desktop monitors.



The Inspiron keyboard almost feels like a desktop keyboard.

UNDER THE HOOD

- ▶ Intel mobile 300MHz Pentium II
- ▶ 64MB SDRAM (expandable to 192MB)
- ▶ 15-inch active-matrix display
- ▶ DVD-ROM Toshiba 2x drive with integrated LuxSonor DVD/MPEG-2 decoder card
- ▶ USB, PS/2, parallel, serial, port replicator, external monitor, audio-in and -out, S-Video-out, infrared

REAL WORLD BATTERY LIFE

02:21:00

PLUSES

- 300MHz Pentium II
- 3D acceleration
- Large display
- Hardware DVD-decoding
- Roomy hard drive
- S-Video-out

MINUSES

- No gameport

REAL WORLD BENCHMARKING

CPU/MOTHERBOARD	140.4
WIN95 APPS	122
HARD DRIVE	6.26
CD-ROM	13x
3D RENDERING	728
DESKTOP PUBLISHING	170
DIRECT3D	37.71
SPREADSHEETS	198

MAXIMUM PC VERDICT

Price $3,700
Company Dell Computer
Phone 800.388.8542
URL www.dell.com

10

▶ BIG MEMORY FOR A BIG DISPLAY

Some would argue that bigger isn't always better, but in the Inspiron's case, bigger is bliss. The massive 15-inch screen provides up to 27% more viewing area than a 13.3-inch display. Of course, bigger displays contain more glass, which results in much greater carrying weights. We think the trade-off is well worth it, especially considering the bright, lush output of the display. One caveat for frequent fliers: Make sure you're seated in first class. You may find it difficult to open this large notebook in mid-flight, especially if the schmuck in front of you decides to recline his seat until it's touching your knees.

The Inspiron benefits from having 8MB of onboard video memory, twice that of most other notebooks. The extra memory comes in handy for higher resolutions and refresh rates when you need to drive an external monitor (the Inspiron supports up to 1600x1200@75Hz). The extra memory also speeds the performance of 3D games that use larger textures and Z-buffers. And because the Rage LT Pro is a 2x AGP part, it can store large 3D textures in system memory—a must as games become more complex and developers embrace the AGP specification.

With a large screen and plenty of video memory, DVD is a natural addition. The Inspiron even includes a built-in MPEG-2/DVD decoder card, eschewing less expensive software-decoding solutions. The end result? Better picture quality, smooth video, and extended battery life.

For definitions of Terminator words, hyperlink to the back of *Maximum PC*, or check out the Terminator online at www.maximumpcmag.com.

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Fujitsu **LifeBook** 990Tx2

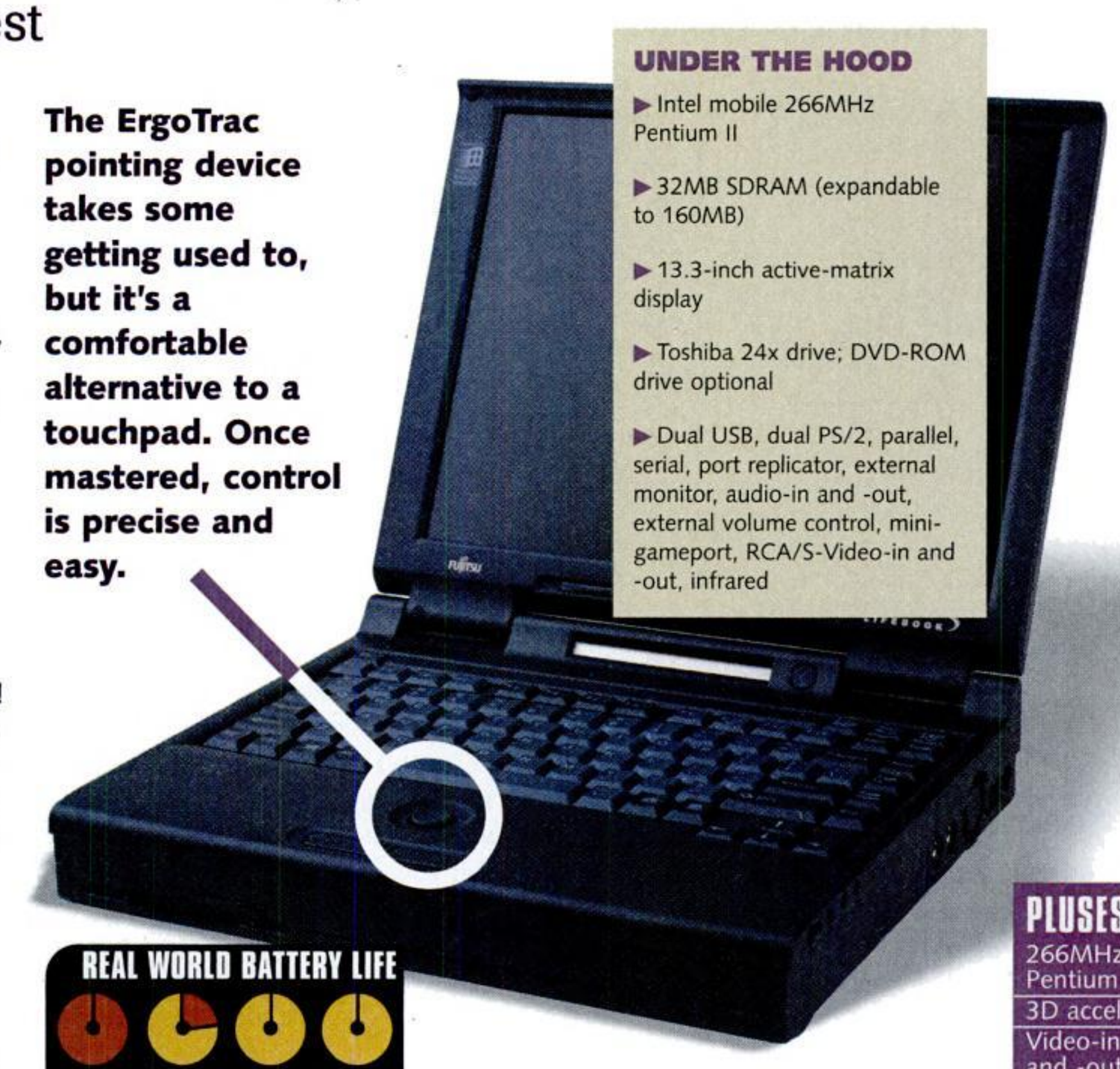
Living life to its fullest

The 3D-supercharged LifeBook 990Tx2 offers an intriguing blend of components that should appeal to both hardcore and casual users.

Unfortunately, the notebook's compelling features—such as a 266MHz mobile Pentium II processor, 13.3-inch display, and AGP graphics—are overshadowed by one major annoyance: short battery life. We could coax only an hour and 15 minutes from our test machine, which isn't even long enough to outlast a flight from Las Vegas to San Francisco. Nothing's worse than seeing those LCD-battery-life icons rapidly disappearing from view. Yikes!

Battery life aside, the 990Tx2 was a solid performer. None of its benchmark scores jumped off the charts in either direction, but overall the notebook impressed us. Of particular note was the Toshiba CD-ROM drive, which clocked in at a respectable 15x performance rating. However, in the when-will-they-ever-learn department, we discovered the 990Tx2 ships with the DMA settings for its CD-ROM and hard drives turned off. Even worse, when we contacted Fujitsu for an explanation, a representative told us DMA was turned off because Fujitsu hadn't encountered any drive "performance issues" and thus saw no reason to toggle on the feature. When we pointed out the idiocy of this, Fujitsu did allude to turning DMA on in future models. Sheesh.

The ErgoTrac pointing device takes some getting used to, but it's a comfortable alternative to a touchpad. Once mastered, control is precise and easy.



UNDER THE HOOD

- Intel mobile 266MHz Pentium II
- 32MB SDRAM (expandable to 160MB)
- 13.3-inch active-matrix display
- Toshiba 24x drive; DVD-ROM drive optional
- Dual USB, dual PS/2, parallel, serial, port replicator, external monitor, audio-in and -out, external volume control, mini-gameport, RCA/S-Video-in and -out, infrared

Instead of a traditional trackpad or pointing stick, the 990Tx2 sports Fujitsu's own ErgoTrac pointing device, a dime-sized nub positioned in a recess above the mouse buttons. It's remarkably comfortable to use, and although it takes a few practice turns, you'll soon be navigating the desktop with new confidence.

Other 990Tx2 goodies include a chunky 5GB IBM hard drive, warm-swappable device bays for floppy, CD-ROM and hard drive, TV-in *and* -out, and wavetable MIDI output. All in all, a solid business machine for corporate types who want to play games on the road.

PLUSES

- 266MHz mobile Pentium II
- 3D acceleration
- Video-in and -out
- ErgoTrac pointing device

MINUSES

- Too many active applets
- Limited battery life
- DMA not turned on

REAL WORLD BENCHMARKING

CPU/MOTHERBOARD	129.5
WIN95 APPS	85
HARD DRIVE	3.48
CD-ROM	15x
3D RENDERING	840
DESKTOP PUBLISHING	291
DIRECT3D	33.34
SPREADSHEETS	228

MAXIMUM PC VERDICT

Price $3,300
Company Fujitsu
Phone 888.466.8436
URL www.fujitsupc.com

8

▶ POLYGONS TO GO

For more than two years, hardcore computer owners have been waiting for mobile 3D acceleration—and now it's here, care of ATI. Like Dell's Inspiron, the LifeBook 990Tx2 uses ATI's Rage LT Pro AGP video chip.

But because the 990Tx2 includes only 4MB of video memory and runs on a slower CPU, it scored 30fps on the *Forsaken* benchmark at 800x600—4fps less than the Dell. And at 1024x768, a high resolution where local video memory becomes much more essential, the LifeBook lagged behind the Inspiron by 8fps. Worse, due to an older video driver, the LifeBook 990Tx2 couldn't run *GLQuake II*, even though the video chip is OpenGL compliant. Still, the Fujitsu does win bonus points for including both RCA and S-Video-in and -out ports.

If you're thinking of purchasing the LifeBook 990Tx2, act fast. Fujitsu is replacing the entire LifeBook line with new models this fall. And although the video subsystem is one of the LifeBook's best features, the Rage LT Pro chipset won't be offered on the newer models. Instead, Fujitsu has decided to dumb down the video subsystem and is switching to a PCI-only, 2MB, 2D-only Trident chipset. In other words, don't expect Fujitsu notebooks to offer 3D acceleration in the future.

At press time, Fujitsu was still shipping LifeBooks with Windows 95. According to a spokesperson, Fujitsu has a holding period for new software so that bugs can be worked out. Customers interested in Win98 will need to contact Fujitsu for information on upgrades. Pre-installation is not offered.

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Sony **VAIO** 505GX

One-inch wonder

The VAIO 505GX is the poster boy for ultra-portable, ultra-cool mobile computing. We were immediately floored by its featherweight design and irresistible styling. And Jiminy Christmas! It's as thin as a mint!

Inside the VAIO's sexy, silver-and-purple magnesium alloy case beats an old-school 266MHz MMX Pentium processor—this notebook isn't expected to go toe-to-toe with its Pentium II brethren. Instead, the 505GX is designed to be a mobile warrior's secret weapon: a computer powerful enough to handle day-to-day tasks and multimedia, but small and lightweight enough to be toted anywhere. In this regard, the 505GX is an absolute dream.

The entire unit weighs roughly three pounds—that's it!—and amazingly manages to house a 56Kbps modem, 10.4-inch active-matrix screen, 2.1GB hard drive, and digital touchpad that lets you to embed your signature or doodles into Windows documents. Even more amazing, the VAIO measures only 10 inches long by 8 inches wide, and is less than 1 inch thick when the case is closed. Factor in the purple battery cylinder that attaches to the rear of the unit, and the nifty little port replicator, which includes a host of other connections, including PS/2 and serial, and the 505GX looks like a candidate for the Museum of Modern Art.

By and large, the 505GX benchmarked considerably slower than other notebooks here. Much of the soft performance can be attributed to the basic Pentium processor, which lacks the oomph of the Pentium II's more advanced core architecture and additional 256K of L2 cache. However, if you don't plan on running a lot of memory-intensive or floating-point-intensive applications, the 505GX will suit you just fine. The notebook ships with 32MB SDRAM, but can be expanded to 96MB. Unfortunately, maximum screen resolution at 24-bit color is 800x600, and despite Sony's music pedigree, you'll be stuck listening to lowly FM synth.

If it's thin you want, the 505GX is the only way to go. In short (no pun intended), this notebook is kick ass. Just be prepared to sacrifice ultimate performance for excellent portability and design.

UNDER THE HOOD

- Intel 266MHz Pentium with MMX
- 32MB SDRAM (expandable to 96MB)
- 10.4-inch active-matrix display
- External 14x CD-ROM drive with PC card interface
- External floppy connector, USB, 1394, port replicator

PLUSES

- Ultra-cool design
- Superportable
- Digital touchpad
- USB/1394 ports
- Magnesium-alloy case
- Integrated modem

MINUSES

- External cables too short
- Slow benchmarks
- No 3D support
- No gameport

MAXIMUM PC VERDICT

Price $2,700
Company Sony Electronics
Phone 888.476.6972
URL www.ita.sel.sony.com

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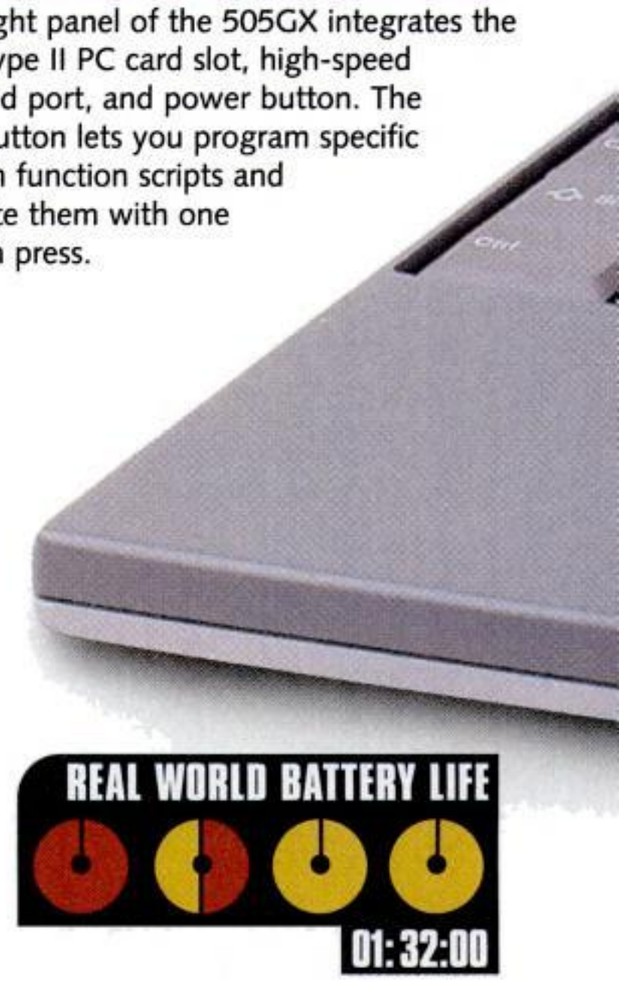
Drive Jive
The 505GX doesn't include an integrated CD-ROM or floppy drive. Instead, you'll have to use the FDD connector (located on the left), along with a PC card interface for the CD-ROM drive. This isn't a huge problem, but the cables on both devices are maddeningly short and inflexible, which makes it difficult to position the devices on a desktop. The CD-ROM drive includes a headphone jack and volume control. Sadly, you can't use it as a portable Discman.

Read Your E-Mail and Run
The right panel of the 505GX integrates the sole Type II PC card slot, high-speed infrared port, and power button. The "P" button lets you program specific system function scripts and execute them with one button press.



REAL WORLD BATTERY LIFE
01:32:00

REAL WORLD BENCHMARKING

CPU/MOTHERBOARD bootMark		59
WINDOWS APPS SYSmark 98	official score	62
HARD DRIVE HD Tach	MB/sec	4.7
CD-ROM CD Tach98	drive rating	12.5
3D RENDERING Newtek Inspire3D	sec	1150
DESKTOP PUBLISHING Adobe Photoshop 5.0	sec	308
DIRECT3D ForsakenMark	fps	— not applicable
SPREADSHEETS Microsoft Excel 97	fps	301

▶ COOL ACCOUTREMENTS

It's the little things that count, the innovations that prove there's more to R&D than the quest for sheer power. The 505GX, for example, includes a plastic stylus that can be used on the digital touchpad to record tracking movement. With the bundled *ScribblePad* software, you can capture your signature or doodles and paste them into

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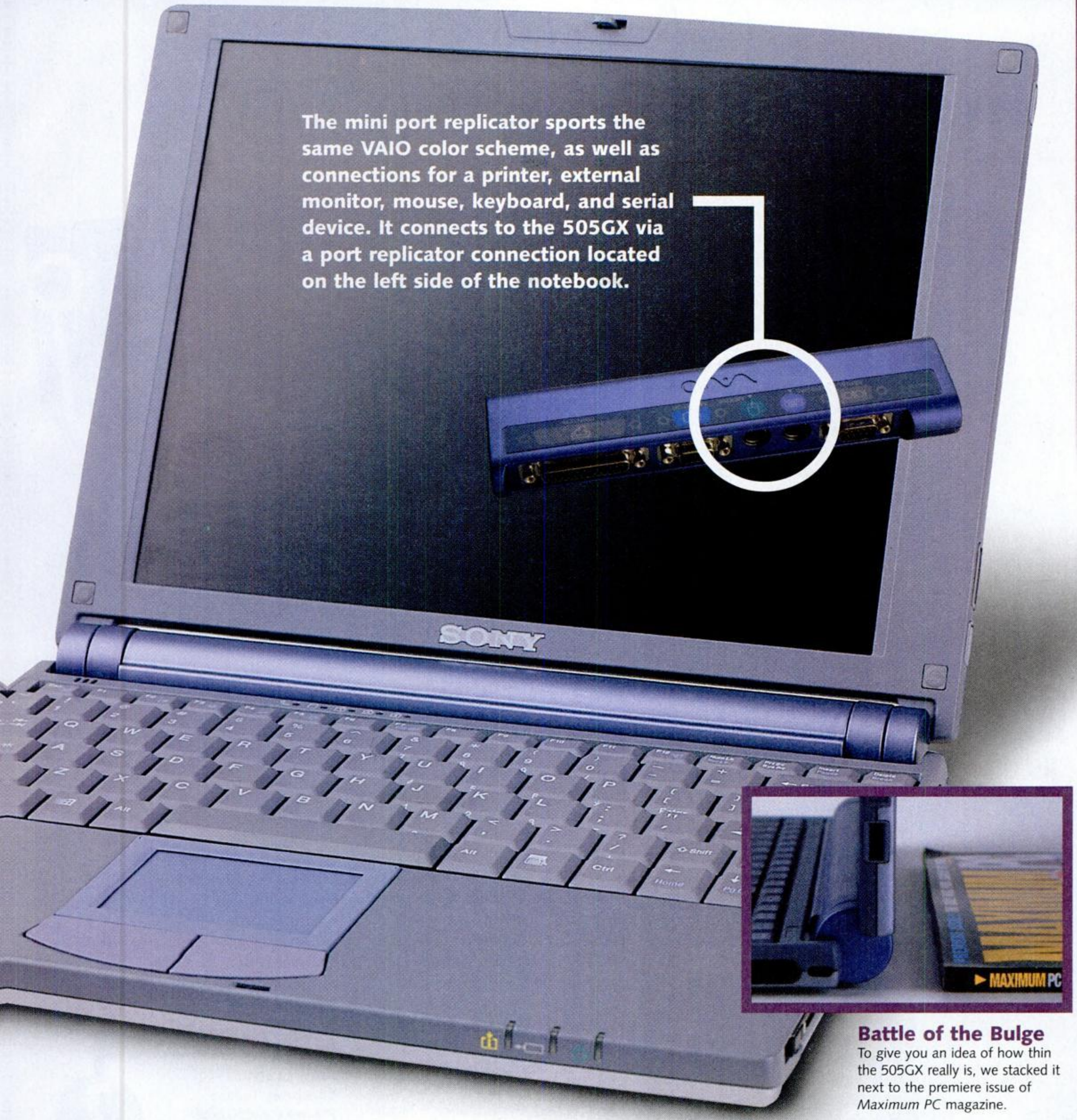


Battle of the Bulge
To give you an idea of how thin the 505GX really is, we stacked it next to the premiere issue of *Maximum PC* magazine.

Windows documents.

The Programmable Power Key (PPK), located on the right panel, enables complex function scripts at a touch of the button. A script can be designed to automatically download new e-mail, open a set of applications, or run any set of tasks in any order. Once the script is finished, the machine can power down automatically.

The 505GX also integrates a single 4-pin 1394 port, dubbed i.LINK, to connect digital-video peripherals such as Sony's Digital Handycam Camcorder. Since this a 4-pin port, you can only use 1394 devices that have a separate power source. To use any 6-pin devices, which draw power from the host source, you'll need an adapter.

Finally, on the durability front, Sony uses a magnesium-alloy shell. This material is popular for camcorders and those "rugged" notebooks you're supposed to use on construction sites, but we've never seen it before in a general-purpose notebook. In addition to facilitating a slim design and reduced weight, magnesium alloy is useful for heat dissipation, negating the need for a cooling fan.

Copyrighted material

Toshiba **Tecra** 780DVD

The good, the bad, and the peculiar

The Tecra's impressive roll call of components begins with power parts—a 266MHz Pentium II, 5GB hard drive, and 13.3-inch display—and segues to fine luxuries such as a snap-on digital-video camera and DVD-ROM drive with hardware-decoding. But as is so often the case, individual components sometimes look better on paper than they do in real life.

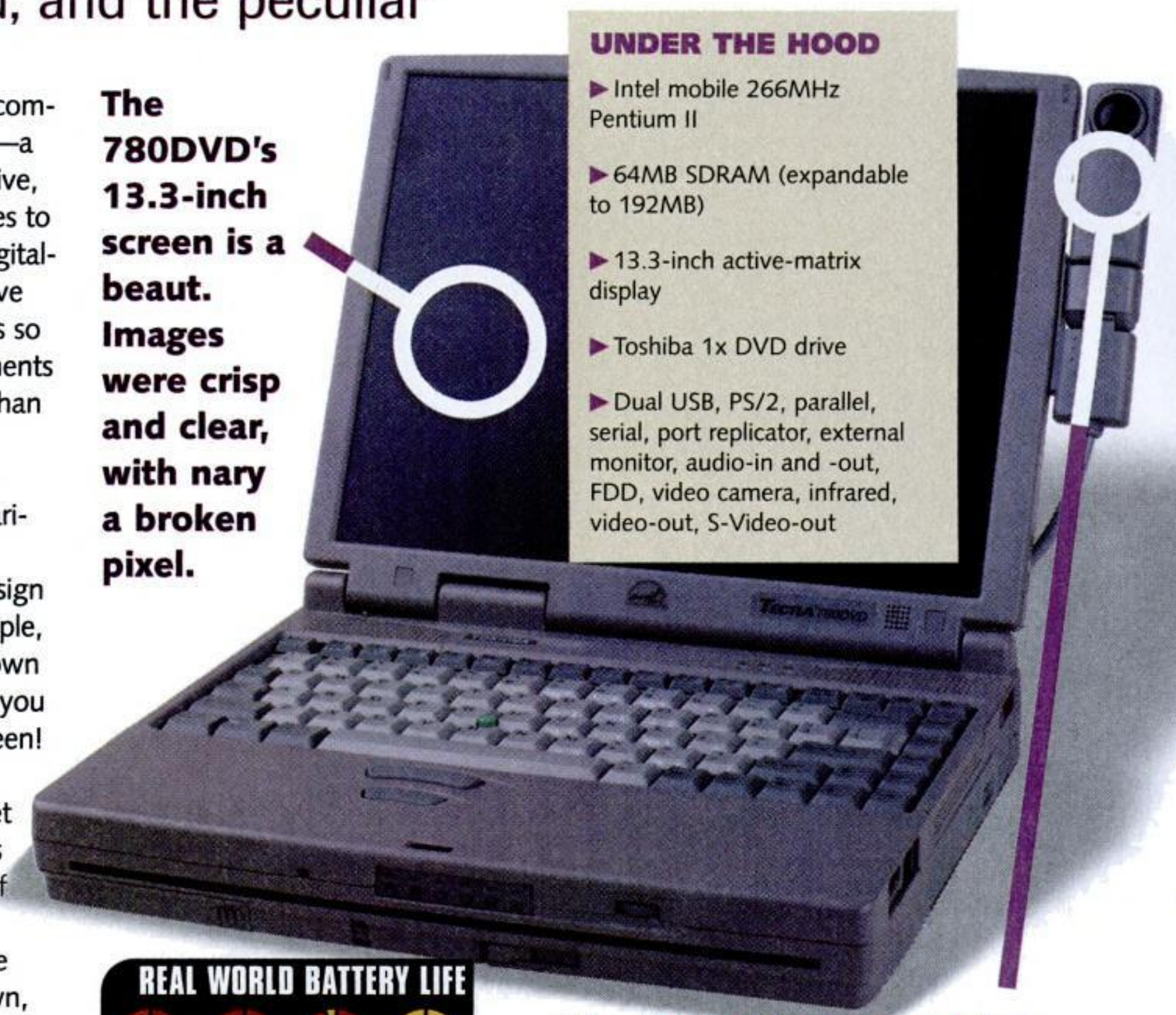
While the 780DVD isn't a bad notebook, it is so rife with peculiarities, you wonder how it was ever approved for sale by Toshiba's design and engineering teams. For example, the notebook includes Toshiba's own MPEG-2/DVD decoder card, but you can't play DVD movies at full screen! Worse yet, you can't even get rid of the Windows taskbar. If you set it to "autohide," it still appears as a solid white line at the bottom of the windowed screen. Even Toshiba's default DVD settings are troublesome: For reasons unknown, the DVD software doesn't automatically open and play DVD files.

We also ran into problems running Direct3D games—the Tecra locked up every time we attempted to play *Forsaken*, *Baseball 3D*, and *Battlezone*. Suspecting a driver conflict, we pressured Toshiba for a fix, and just as we went to press, we received new drivers. We were able to play D3D games, but unfortunately the visual quality left much to be desired. Running *Forsaken* at 800x600, the 780DVD mustered a measly 7.84fps and revealed its nasty alpha-blending problems. And despite the fact that Toshiba touts OpenGL compatibility on its printed and online spec sheets, we could not get *Quake II* to run.

But as we said, the 780DVD isn't all bad. Performance was solid if not jaw-dropping, and we also liked the 10x performance rating garnered by the first-generation DVD-ROM drive, as well as the video-out ports.

Finally, the 780DVD gets kudos for great battery life (almost three hours!) and its integrated 56Kbps modem.

The 780DVD's 13.3-inch screen is a beaut. Images were crisp and clear, with nary a broken pixel.



UNDER THE HOOD

- ▶ Intel mobile 266MHz Pentium II
- ▶ 64MB SDRAM (expandable to 192MB)
- ▶ 13.3-inch active-matrix display
- ▶ Toshiba 1x DVD drive
- ▶ Dual USB, PS/2, parallel, serial, port replicator, external monitor, audio-in and -out, FDD, video camera, infrared, video-out, S-Video-out

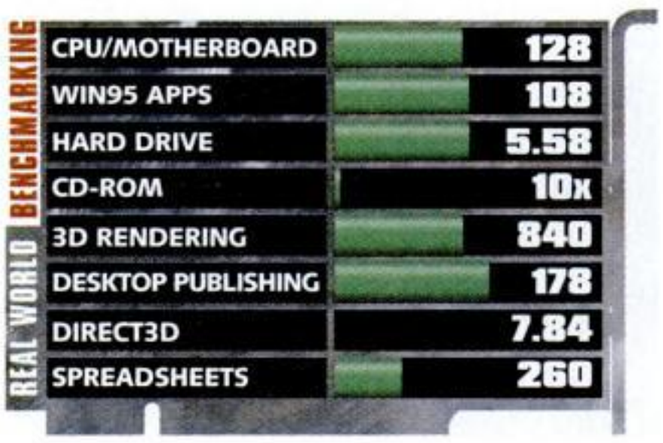
PLUSES

- 266MHz mobile Pentium II
- DVD-ROM drive
- Digital-video camera

MINUSES

- 3D wouldn't run
- DMA not turned on
- High price
- No gameport

The 780DVD is primed for video conferencing with its snap-on digital camera.



MAXIMUM PC VERDICT

Price $4,400
Company Toshiba
Phone 800.550.5690
URL computers.toshiba.com

7

▶ BATTING .333

Toshiba went one-for-three in its implementation of Ultra DMA, 3D acceleration, and a digital-video camera. For starters, the 780DVD ships with the DMA settings for its DVD-ROM drive and hard drive turned off. If you've ever wondered why this is a big deal, take a look at the hard drive's CPU utilization before and after we enabled DMA: 98.8% versus 10%. And after DMA was turned on, the hard drive transfer rate increased from a lowly 3.4MB/sec to 5.58MB/sec. Enabling DMA isn't a big deal, and there's no reason system manufacturers can't do it on the assembly line.

We were also crestfallen to discover that the ViRGE/MX chipset, S3's first mobile 64-bit 3D accelerator, played 3D games so poorly. The ViRGE/MX will soon give way to a mobile version of S3's highly touted Savage3D. Although S3 wouldn't provide specifics on availability or features, the company did tell us the new chip would mirror its desktop counterpart. If it does, it will blow away ATI's Rage LT Pro, which is currently the best mobile 3D accelerator around. No word yet as to whether Toshiba plans to adopt it, though.

The Tecra did get a solid hit with its color digital-video camera. It snaps onto the side of the LCD display and pivots so the lens can be easily rotated and tilted. Bundled software includes Microsoft *VidCap*, which allows you to capture still images at up to 640x480, and *VideoBrush Whiteboard*, a video-editing program.

Copyrighted material

Micron **Transport** Trek²

Trials and Tribble-lations

Micron notebooks have always impressed us, so after scanning the Trek²'s spec list, we had high hopes that Micron would deliver once again. With a 266MHz mobile Pentium II, 14.1-inch screen, 24x CD-ROM, and 64MB of SDRAM, what could possibly go wrong?

How about the video subsystem? In this case, it just plain sucked.

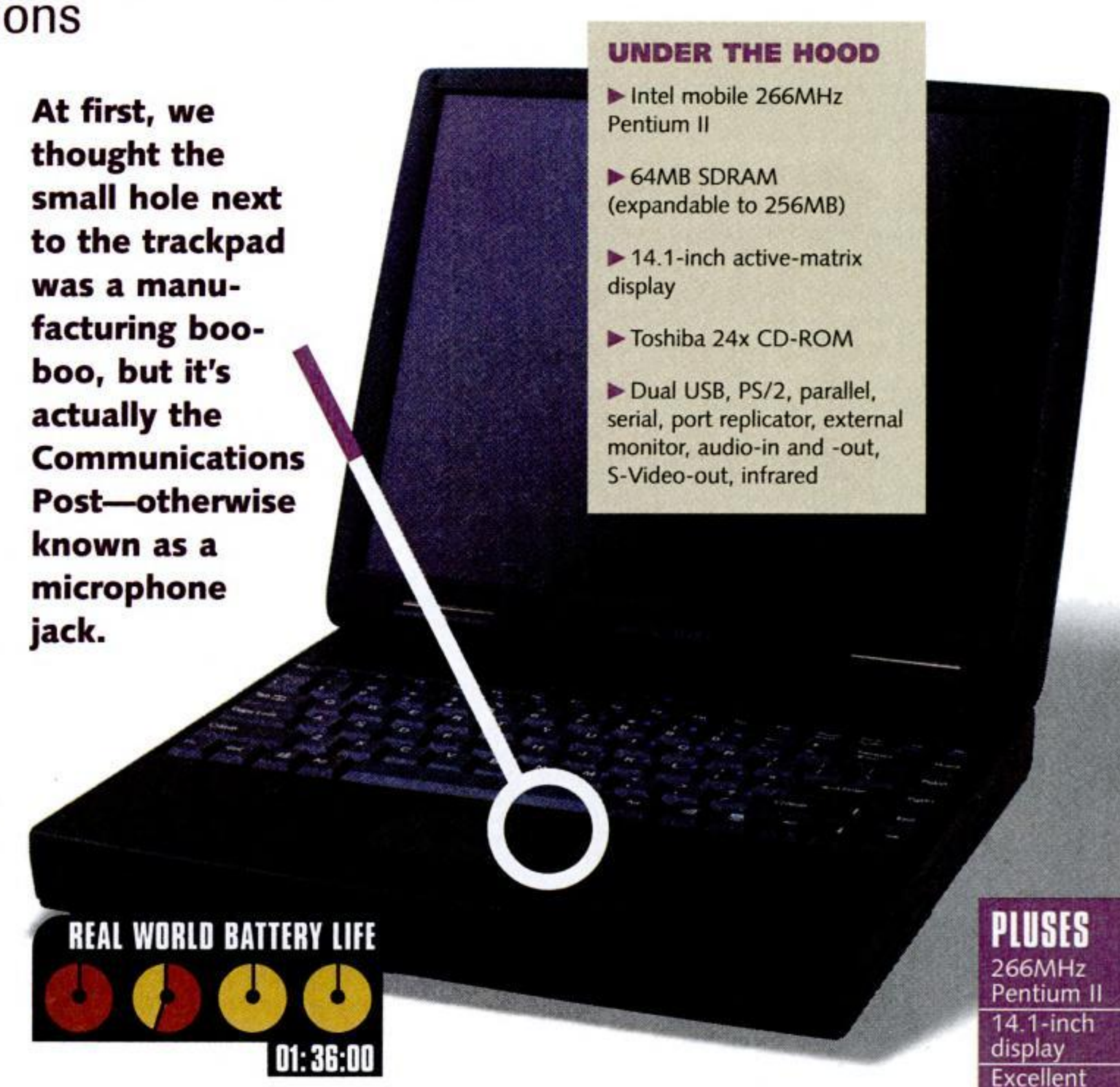
We were looking forward to testing the 4MB Trident Cyber9397 chipset, one of the few mobile 3D accelerators to emerge during the recent notebook renaissance. Unfortunately, the Trident performed so atrociously, we have to wonder whether the typically superb Micron engineers were chugging Romulan ale when they decided to integrate this obvious Ferengi reject. Coughing up only 5.59fps in *Forsaken* and with MPEG playback too horrible to describe, the Cyber9397 defies logic. A lush, large LCD display is a wonderful feature, but looking at ugly images on a screen that big just doesn't cut it.

The hard drive and CD-ROM drive, on the other hand, were what we've come to expect from Micron. The 3.2GB hard drive (larger capacities are available) transported data at a fleet 5.62MB/sec. The CD-ROM drive, meanwhile, spun discs into warp at 16.5x, the fastest speed we've seen from a notebook to date. And in a testament to Micron ingenuity, the Trek²'s bootMark of 141.8 bested even the 140.4 scored by the Dell Inspiron and its faster 300MHz mobile Pentium II. Engage!

The Trek² also includes 3Com's Megahertz 56K PC card modem, a strange choice considering the case has space inside for an integrated modem port. A DVD-ROM drive wasn't included in our test system, but is available as a modular option for an additional $299. A carrying case is also extra.

If you're looking for a notebook that will propel you into the next multimedia millennium, you'd be wise to steer clear and chart an entirely different course.

At first, we thought the small hole next to the trackpad was a manufacturing boo-boo, but it's actually the Communications Post—otherwise known as a microphone jack.



UNDER THE HOOD

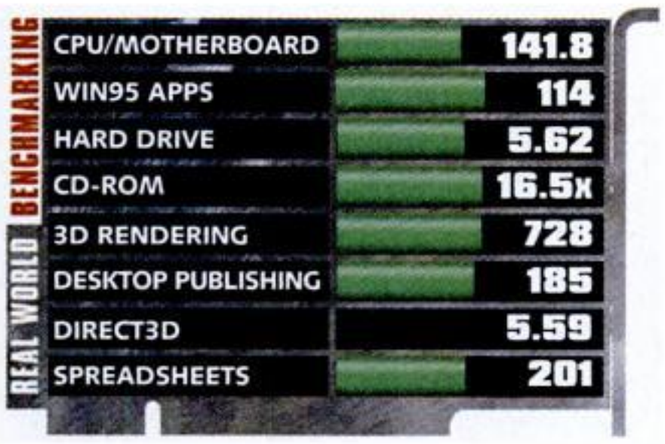
- Intel mobile 266MHz Pentium II
- 64MB SDRAM (expandable to 256MB)
- 14.1-inch active-matrix display
- Toshiba 24x CD-ROM
- Dual USB, PS/2, parallel, serial, port replicator, external monitor, audio-in and -out, S-Video-out, infrared

PLUSES

- 266MHz Pentium II
- 14.1-inch display
- Excellent performance

MINUSES

- Lousy video subsystem
- No gameport
- No integrated modem



MAXIMUM PC VERDICT

Price $2,700
Company Micron
Phone 800.209.9686
URL www.micronpc.com

6

▶ BAD SPEED, BAD VISUALS

With its poor performance, the Cyber9397 1x AGP video chipset earns the distinction of being the worst mobile video chip we've ever had the misfortune of laying our eyes on.

So just how bad is it? For starters, it's supposed to be Direct3D-compatible, and although D3D games will run on it, the resulting images are so horrible, you'll want to close your eyes to shut out the offending content. In Forsaken, the chip pumped out a paltry 5.59fps at 800x600, and during a bout of Monster Truck Madness 2, we were astonished by how bad the game actually looked. Clipping, transparencies, and alpha-blending problems abounded, with atrocious framerates to boot. But the problems aren't limited to games. MPEG playback was just as bad, with major banding, ghosting, and out-of-sync audio. Simply horrible.

One thing we did admire about the Trek2 was its svelte system overhead. While most notebook vendors clutter their hard drives and Start menus with a bunch of useless applets, desktop schemes, and, in the very worst cases, Microsoft's Active Desktop, Micron's machines are always refreshingly junk free. This helps save storage space and ensures no superfluous applications are siphoning system resources when you're running your favorite applications.

Micron also offers a host of options that includes a $599 desktop package and a $199 multimedia port replicator.

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Dare to **Compare**

Here's the skinny on this month's supermodels. Find your essential personality traits, and then make your move. It's better to have loved and lost than never to have loved at all.

	DELL INSPIRON	FUJITSU LIFEBOOK	SONY VAIO	TOSHIBA TECRA	MICRON TRANSPORT
Processor	300MHz P-II	266MHz P-II	266MHz Pentium MMX	266MHz P-II	266MHz P-II
Memory	64MB	32MB	32MB	64MB	64MB
Screen Size	15.1	13.3	10.4	13.3	14.1
Video Memory	8MB	4MB	2MB	4MB	4MB
Hard Drive Size	8GB	5GB	2.1GB	5.1GB	3.2GB
Integrated Floppy/CD	Yes	Yes	No	No	Yes
Integrated Modem	Yes	Yes	Yes	Yes	No
Direct3D Support	Yes	Yes	No	Yes	Yes
Wavetable Sound	Yes	Yes	No	Yes	Yes
Battery Life (hours:min)	2:21	1:14	1:32	2:53	1:36
Weight	9lbs 4oz	8lbs, 11.2oz	3lbs	7lbs, 13oz	7lbs, 11.2oz
Dimensions (LxWxH)	12.7x10.2x2.2	12.3x10.2x2.4	10.2x8.2x0.94	11.9x9.4x2.1	12.2x9.8x1.8
bootMark	140.4	129.5	59	128	141.8
Price	$3,700	$3,300	$2,700	$4,400	$2,700
Verdict	10	8	9	7	6

▶ BUYING THE BEST NOTEBOOK POSSIBLE

There's a special rulebook for buying notebook computers. If you're new to the mobile game, read these tips before plunking down your money.

▶ **CPU** When it comes to power, nothing beats the latest CPU. But before you buy, consider the applications you'll be running. If e-mail and word processing are all you're interested in, consider a CPU one or two speeds below state-of-the-art. Keep in mind, however, that notebooks can't be upgraded like desktop systems, and you won't be able to swap your CPU for a faster one. Special purchasing tip: You can get yourself a great notebook deal whenever Intel introduces a new mobile CPU line.

▶ **VIDEO** If multimedia is important to you, make sure the notebook supports Direct3D and resolutions of at least 1024x768 at 16-bit color. If DVD is an option, find a notebook with an integrated hardware DVD/MPEG 2-decoder card. Software-assisted DVD generally doesn't look as good, but is cheaper to implement. Some notebooks also offer PC card–based decoder cards.

▶ **SOUND** Stay away from FM synth. Only wavetable audio is acceptable if you want sound that rivals desktop quality.

▶ **POINTING DEVICE** Give yourself time to get used to touchpads and pointing sticks. Most people like them just as much as trackballs, and most notebooks include software that allows you to adjust sensitivity and motion.

▶ **SCREEN SIZE** If you're after a desktop replacement, you should strive for a 15-incher, the largest size you'll find in a notebook. Bear in mind, however, that the bigger the screen, the heavier the notebook will be. Balance your display needs with your muscularity.

▶ **KEYBOARDS** Look for full-sized keys, intelligently placed cursor controls, and a Windows key.

▶ **PORTS** You'll want TV-out, USB, parallel, serial, audio, and dual PS/2 (to connect an external mouse and keyboard; some notebooks have a single connection for both). Make sure a docking station or port replicator is an option, just in case.

▶ **STORAGE** If device swapping isn't your idea of fun, the notebook should integrate the floppy drive and CD/DVD-ROM drives simultaneously. Make sure the hard drive has enough capacity to fill your needs.

▶ **BATTERY LIFE** Most notebooks offer device bays that let you swap out a floppy or CD-ROM drive for an additional battery. If you're planning on intercontinental flights, consider purchasing an extra battery.

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Does the thought of no partitions terrify you?

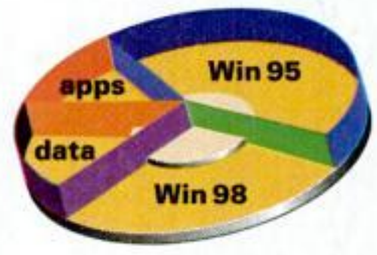
(No wonder your computer keeps freezing up.)

Create, Resize, Move and Convert partitions with PartitionMagic® 4.0

PartitionMagic 4.0 works with Windows 98 and includes a free copy of BootMagic. Buy it now and get $15 back from PowerQuest.

Visit your local software reseller or call 1-800-379-2566 or +1-801-437-8900 for details.

You couldn't operate without partitions. What makes you think your computer can? Partitioning your hard drive plays an essential role in maintaining your computer—preventing conflicts, protecting data, and dramatically improving efficiency. Best of all, partitioning lets you reclaim up to 40% of your wasted hard-drive space! And now, with even greater functionality and ease of use, PartitionMagic 4.0 puts all the benefits of hard-drive partitioning within easy reach of anyone. Create and resize partitions on the fly without losing data. Effortlessly move applications between partitions, converting from FAT to FAT32 and back again. Or use BootMagic,™ included with your purchase of PartitionMagic, to manage and switch between multiple operating systems. Whatever the task, PartitionMagic will help you get it done! So don't get caught with your pants down. *Get PartitionMagic*.



Partitioning better organizes and protects your data and makes running multiple OSs safe and easy!

boot KICK ASS! PRODUCT

WINDOWS MAGAZINE WIN 100 1998

BEST OF BYTE COMDEX Fall '98

Software Development PRODUCT EXCELLENCE AWARD 1998

Windows Stellar FEBRUARY 1997

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POWER PQ QUEST

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the skinny on

digital cameras

The point-and-shoot model from Olympus shown above is portable, but the Umax PhotoRun (less than an inch thick and weighing in at less than 3 oz.) fits in the pocket of your tightest jeans.

notebooks

Even a few extra pounds can add up to an aching back. This svelte Sony 505GX VAIO tips the scale at just over 3 lbs, about half the heft of most other notebooks.

PHOTOGRAPHY BY AARON LAUER

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new technology

Look around: The biggest news in technology these days comes in the smallest package. Want proof? Everything on this spread is shown actual size!

multimedia speakers

Even boxy speakers suffer from point-source sound quality, but these one-inch thick electro-planar speakers from Monsoon spread the origin over a broad area for a more natural sound.

So how do designers go about getting this gear portable enough to fit on Batman's utility belt? It's a combination of new technology and design decisions.

The ultrathin MM-1000 speakers from Monsoon replace the bulky cone-and-enclosure design for an electro-planar design that operates sort of like a high-frequency sawblade being vibrated.

When it comes to putting that porky monitor on the Slim-Fast plan, the secret is getting rid of the CRT that consumes so much space. Today's flat-panel displays replace that bulky tube with a slender TFT that does the same job.

The same principal holds for getting our notebook PC closer to the proportions of it's paper namesake. By taking out the big-boned floppy and CD-ROM drives, and making optional devices of them, Sony was able to wrap the whole package in a magnesium alloy skin that dissipates heat.

PDAs are by nature pretty damn portable, but the REX takes it to the next level by integrating the device's shell with its PC card interface. This design decision required certain sacrifices—data input being the most glaring—but resulted in a uniquely pocketable tool.

The secret to Umax's rail-thin digital camera lies in the space savings associated with using a teensy CCD and lens combo. As a rule, the larger your CCD, the larger lens you require and the larger distance the two require between them.

What next? Printer/scanner combos the size of a sheet of paper? PDA on a fingernail? Mouse controller embedded in your retina? Only time will tell, but this is definitely the direction.

pdas

"Pocket-size" is no longer state-of-the-art for personal digital assistants. This REX from Rolodex is just a PC card with an LCD screen and touch pad controls. It fits in your wallet.

monitors

They call them "desktop" computers, but it's really the damn monitor that hogs all the real estate on your desk. Flat panels, such as this 1 5/8-inch thick Princeton DPP 500, resolve the land grab peacefully—and look so cool.

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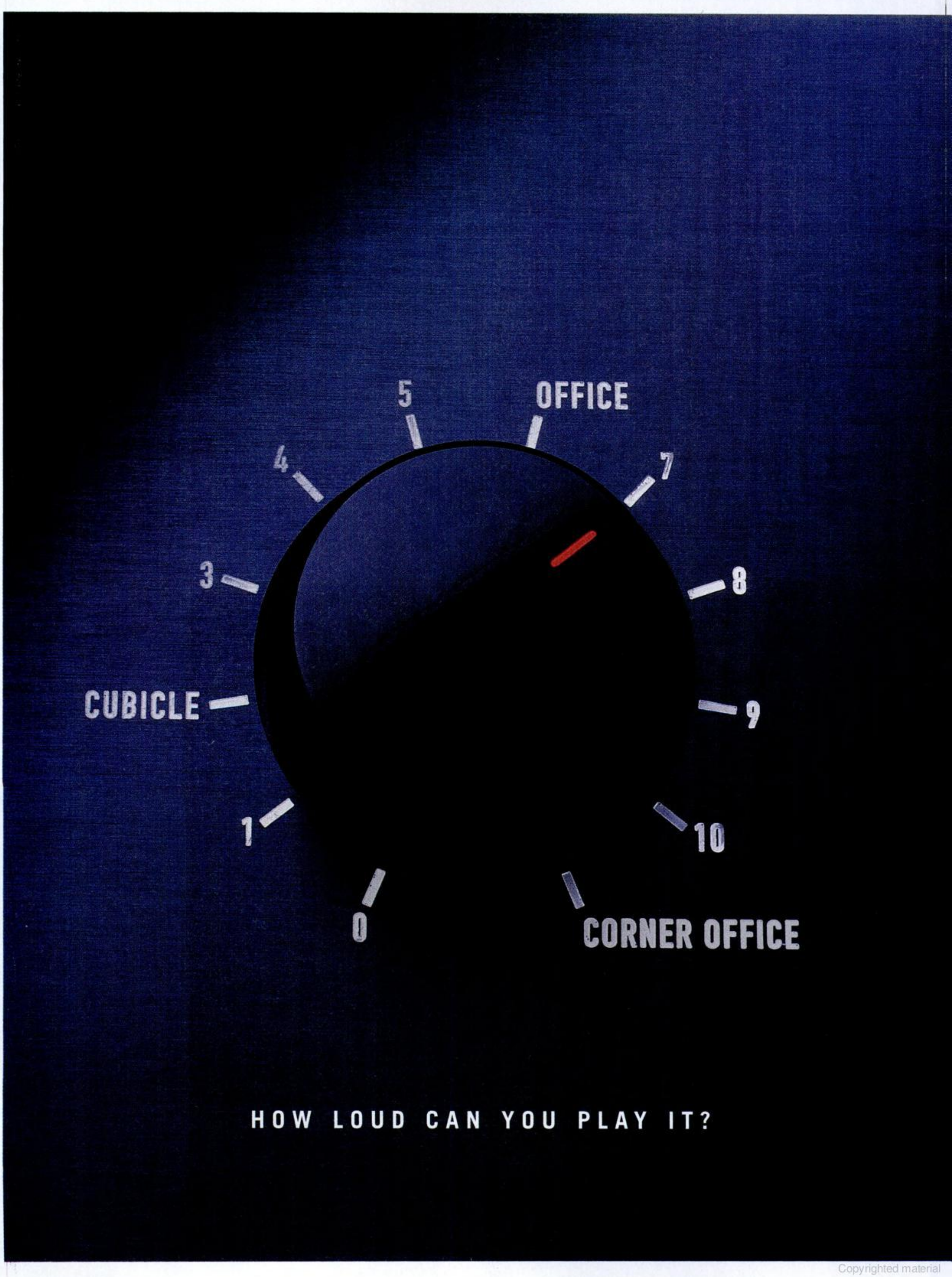

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Work is Hell, but at least now there's a soundtrack. Introducing Spinner.Com, a musical cure for the monotony of the workday. If you've got an Internet connected computer on your desk (they give you one of those, right?) you can choose from over 100 channels of continously playing music. That's right: one song after another. For instance, you could choose "classical quartets" to ease you into the morning and as the day gets frantic, you could switch to "Jungle." Whatever's fitting. 100,000 songs and it's all up to you.

After all, they may still decide the volume, but it's still your music.

Go to the premier Internet music service at www.spinner.com, or download the Spinner Plus player for enhanced features. Oh, and like the coffee at work - it's free - only much better.

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spinner.com

You've never heard music like this before.

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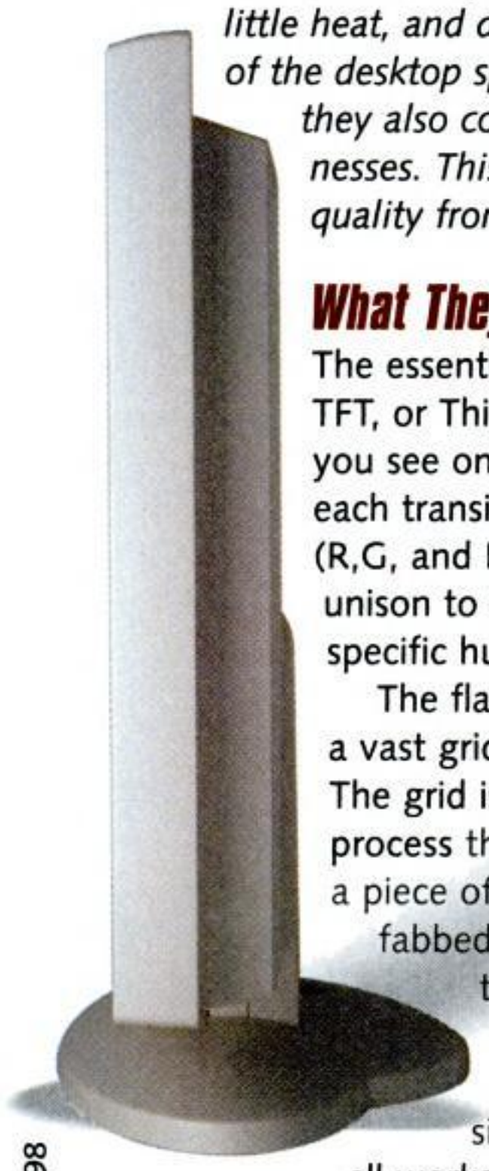
They're hot. They're sexy. They're alive with pixels. Here's the skinny on Flat-panel Monitors

With styling straight from the 23rd century, flat-panel monitors are irresistibly high-tech—the dashing new celebrities of the computer world. But while these waifish wonders require scant power, emit little heat, and demand just a fraction of the desktop space required by traditional CRT displays, they also come with their own idiosyncratic weaknesses. This month, we review 11 panels, ranging in quality from crap to kick ass.

by Jon Phillips



What They Are and How They Work

The essential component inside any flat panel is the TFT, or Thin Film Transistor. Each individual pixel you see on screen is comprised of three TFTs, with each transistor controlling a different primary color (R,G, and B). These little transistor teams work in unison to mix RGB values and generate a pixel's specific hue.

The flat panel's numerous TFTs are arranged in a vast grid (often casually called a TFT as well). The grid is manufactured via a photolithography process that "grows" the transistors en masse on a piece of glass (in this respect, the TFT grid is fabbed much like a CPU). Between the transistor grid and another piece of glass lies a pool of liquid crystal solution that's just molecules thick. Behind this assembly sits a fluorescent backlight. Here's how it all works: The TFT assembly is essentially a matrix of light valves. When voltage is applied to a transistor, the liquid crystals that swim on top of it react by "straightening out," denying light from shining through—the pixel is off. When voltage is removed, the crystals twist at an angle to let light pass through—the pixel is on.

Wanna play *Who's the Skinny on Screen*? See page 127 for answers.

72

▶ EIZO FlexScan L66

With an 18-inch diagonal viewing area and natural resolution of 1280x1024, the FlexScan L66 will wow you silly with a decadent sprawl of screen real estate. And like all EIZO displays, the L66 offers an array of exacting controls to help you get perfect image quality. But unfortunately, the clock and phase controls couldn't fix the small but noticeable amount of visual noise introduced by the panel's analog conversion. We've seen much worse pixel tracking, but we've also seen much better in panels that cost less than half of the L66's bodacious street price.

Other annoyances include slight ghosting and poor grayscale reproduction on the black end of the spectrum. In a 256-gray gradient going from pitch black to absolute white, the 32 darkest grays appeared as a chunk of near-solid black. The next 32 grays showed a hint of the same problem, while the effect diminished accordingly toward the white end of the spectrum. Still, the bright, lush L66 boasts excellent off-axis viewing and screen uniformity (the TFT was manufactured by Sharp). Text reproduction was also surprisingly good given the display's analog-conversion problems. Throw in zero stuck pixels, USB hubs, and an optional wall-mount, and you have a good reason to ditch your 19-inch CRT.

MAXIMUM PC VERDICT

Price $3,600
Company EIZO
Phone 800.800.5202
URL www.eizo.com

8

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IS IN

▶ Samsung SyncMaster 520

If awards were given for chassis beauty alone, the 15-inch 520TFT would strut down the catwalk with first prize. Too bad the panel's grayscale performance is dog-ugly.

The 520TFT cannot produce grays on the light end of the grayscale spectrum. The flaw was woefully apparent in *DisplayMate's* White Level Saturation test. In this test, blocks of varying light grayscale values appear against a white background; the more blocks that appear on screen, the better the panel's ability to display white-end grayscaling. When auto-adjusted to its optimum settings, the 520TFT displayed no blocks whatsoever. That's bad. CRTs and good TFTs can display 13 of 16 blocks, but to get this kind of output from the otherwise brilliant 520TFT, we had to dramatically lower contrast, screwing up overall picture quality.

Auto-adjustment also set the 520TFT to the worst pixel tracking we've ever seen. Thankfully, the fine-image lock control corrected most of the noise, leaving us with relatively nice text rendering. Screen uniformity was also good, with no darkening on the screen borders and no stuck pixels. We can't forgive the grayscaling problem, but if you want a panel that makes you feel like Geordi LaForge—we dig the metallic finish—you've found home.

MAXIMUM PC VERDICT

Price $1,476
Company Samsung
Phone 800.933.4110
URL www.samsung.com

7

▶ iiyama Pro Lite 36

It seems every panel has its own fatal flaw, and in the Pro Lite 36's case, the breach is the worst screen uniformity of this roundup. This rather dim 14.1-inch display (TFT courtesy of NEC) suffers from the double-whammy of noticeable darkening around the screen borders and impotent color saturation on the bottom half of the screen. Looking for good image reproduction? Forget about it. The Pro Lite 36 lacks all the color brilliance found in every other panel we reviewed this month. The washed-out colors below the equator are unforgivable, as is the omission of a contrast control, which would have helped to address the panel's poor performance on the white end of the gray scale.

A contrast control could also have given text more pop, saving the Pro Lite 36 from such a low verdict. While the phase control eliminated most of the display's pixel tracking noise, text was still hard to read due to the panel's lack of contrast definition. Bad color reproduction, bad text rendering.... Is there any reason at all to buy the Pro Lite 36? Aside from the lack of stuck pixels and only the slightest suggestion of ghosting, no. You can do much better for $900, and prettier panels will soon be hitting this price neighborhood.

MAXIMUM PC VERDICT

Price $900
Company iiyama N. America
Phone 800.394.4335
URL www.iiyama.com

4

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Besides consuming little desk space and emitting trivial amounts of heat, a flat panel offers zero geometric distortion because, unlike a CRT, its pixels are fixed in place. Color saturation is often superior to CRTs, as well. This means bright, lush images that leap off the screen. But of course everyone *really* buys flat panels because they look so damn futuristic.

What Can Go Wrong

Flat panels have come a long way since the days of underpowered backlights and terrible off-axis viewing, but in many ways they still can't measure up to traditional monitors:

- Because their pixels are fixed in place by the TFT grid, flat panels support only one "natural" resolution (all but one panel here defaults to 1024x768). Other resolutions can be shoehorned into the fixed grid via interpolation algorithms, but look jaggy with artifacts.
- Not all transistors will function properly—some can be permanently stuck on or off. These broken pixels become annoying beacons when they appear against a high-contrast background.
- Many flat panels have trouble producing the full grayscale range. For example, dark grays may not appear against a black background. Grayscales can also abruptly jump from one intensity to another instead of seamlessly ramping up and down.
- Color range is also problematic. Any CRT may display 16-bit color, but many flat panels fall short of true 16-bit performance, so a 16-bit image might suffer from banding and dithering.

Compaq TFT500

MAXIMUM PC KICK-ASS! product

Words can't describe the limpid sheen of the TFT500's display. The TFT itself (manufactured by Mitsubishi) sits behind a unique antiglare protector, which gives the panel a beautiful, glow. Add this effect to the richest color saturation in the roundup, and you've got something magical. The 15-inch panel had no stuck pixels and nearly flawless pixel tracking. The little visual noise we did encounter was easily eliminated with the clock phase control, leaving us to wonder why we would ever need the "clock phase fine" control. What does that correct? Radiowave interference from Beta Antares IV? Indeed, unlike the many manufacturers that seem to treat analog-to-digital conversion as an afterthought, Compaq has tackled the technological puzzle head-on and won.

With awesome image and text reproduction, great off-axis viewing, excellent grayscaling, USB terminals, and an aggressive price, the TFT500 has only one problem: significant streaking. Nonetheless, we recommend this panel before all others. And because it offers one more inch than the Hitachi for $200 less, the TFT500 is the only panel here to receive the Kick-Ass award.

MAXIMUM PC VERDICT

Price $1,200
Company Compaq
Phone 800.888.5858
URL www.compaq.com

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Princeton DPP 500

The 14-inch DPP 500 comes bundled with the 4MB ATI XpertLCD videocard. This controller boasts both 15-pin and digital connectors, and is ATI's bid to set a digital interface standard. Working together, the DPP 500 and XpertLCD demonstrate just how clean a TFT display can be when not hindered by the analog-conversion process. Text was absolutely fuzz-free, and looked measurably better than the output from the Compaq and Hitachi panels, which had the least analog-conversion noise in this roundup.

While the DPP 500 exhibited good screen uniformity, almost imperceptible ghosting, and only one stuck pixel, it did suffer from errant grayscale reproduction on both ends of the spectrum. The flaws wouldn't be so bad if Princeton gave you the opportunity to make corrections, but aside from a brightness adjustment, the DPP 500 doesn't come with any controls! We have to whack Princeton for denying us essential contrast and color controls. Still, we have to like this high-tech digital hardware bundle that rings in at less than $1,000. The AGP videocard does double-duty as a mediocre 3D accelerator, and who can resist the deco speaker holes and integrated mike? This is a great panel for office types—just make sure you like its default contrast settings.

MAXIMUM PC VERDICT

Price $970 (with card)
Company Princeton
Phone 800.747.6249
URL www.prgr.com

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► In areas of high contrast, panels can exhibit streaking and ghosting. This effect most often haunts solid bars.

► Because flat panels require a digital signal, they have to convert the analog signal that flows from almost all videocards. This analog-to-digital conversion usually occurs onboard the panel itself and requires that each analog pixel be tracked and locked into its digital counterpart—an imperfect process that introduces visual noise akin to TV snow. While some onboard circuitry does a great job at conversion, in its most vivid manifestation, pixel noise can make text fuzzy and windows pop and sizzle like burning cooking oil. Luckily, pixel noise can be addressed with on-screen controls and eliminated entirely with the use of a pure digital videocard interface.

► Poor screen consistency can appear as mottled colors and darkness around the edges of the panel.

► Some companies buy cheap TFTs from other manufacturers, leading to quality-control problems.

► Flat panels still cost a lot more than CRT monitors.

How to Test a Flat Panel

We used Sonera Technologies' *DisplayMate* diagnostic utility (**www .displaymate.com**) as a visual benchmark to test these panels. This software contains test screens that evoke the very worst flaws a panel will ever display. Besides testing each panel individually, we compared them to each other with the help of an Extron P/2 DA6 PLUS (**www .extron.com**). This one-input/six-output

► Panasonic PanaFlat LC50S

The 15-inch LC50S boasts a bright, vivid display, and its negligible pixel tracking problems could be all but eliminated with an adjustment of the horizontal fine-tune control. Color tracking and grayscale reproduction is where the LC50S's Panasonic-manufactured TFT falls short. On the dark end of the grayscale spectrum, grays close to pure black are cast with a decidedly purplish hue. This was particularly obvious in DisplayMate's 256-gray gradient test. The darkest grays appeared as a solid block of jet black, and abruptly segued into a solid chunk of magenta before shifting back to gray and ramping evenly through the ever-lightening grayscales. Neither color temperature adjustments nor RGB channel tweaks could fix the problem.

While the LC50S displayed well-defined text and almost no ghosting, the panel we received for review was riddled with eight stuck pixels—the highest number we've encountered. If we were looking for a panel to display office apps, we could forgive the color-tracking problems, which have no bearing on clean text reproduction. And the LC50S does come with speakers and USB terminals. Those stuck pixels, however, are like dings on a new car and will break your heart every time you see them.

MAXIMUM PC VERDICT

Price $1,700
Company Panasonic
Phone 800.742.8086
URL www.panasonic.com

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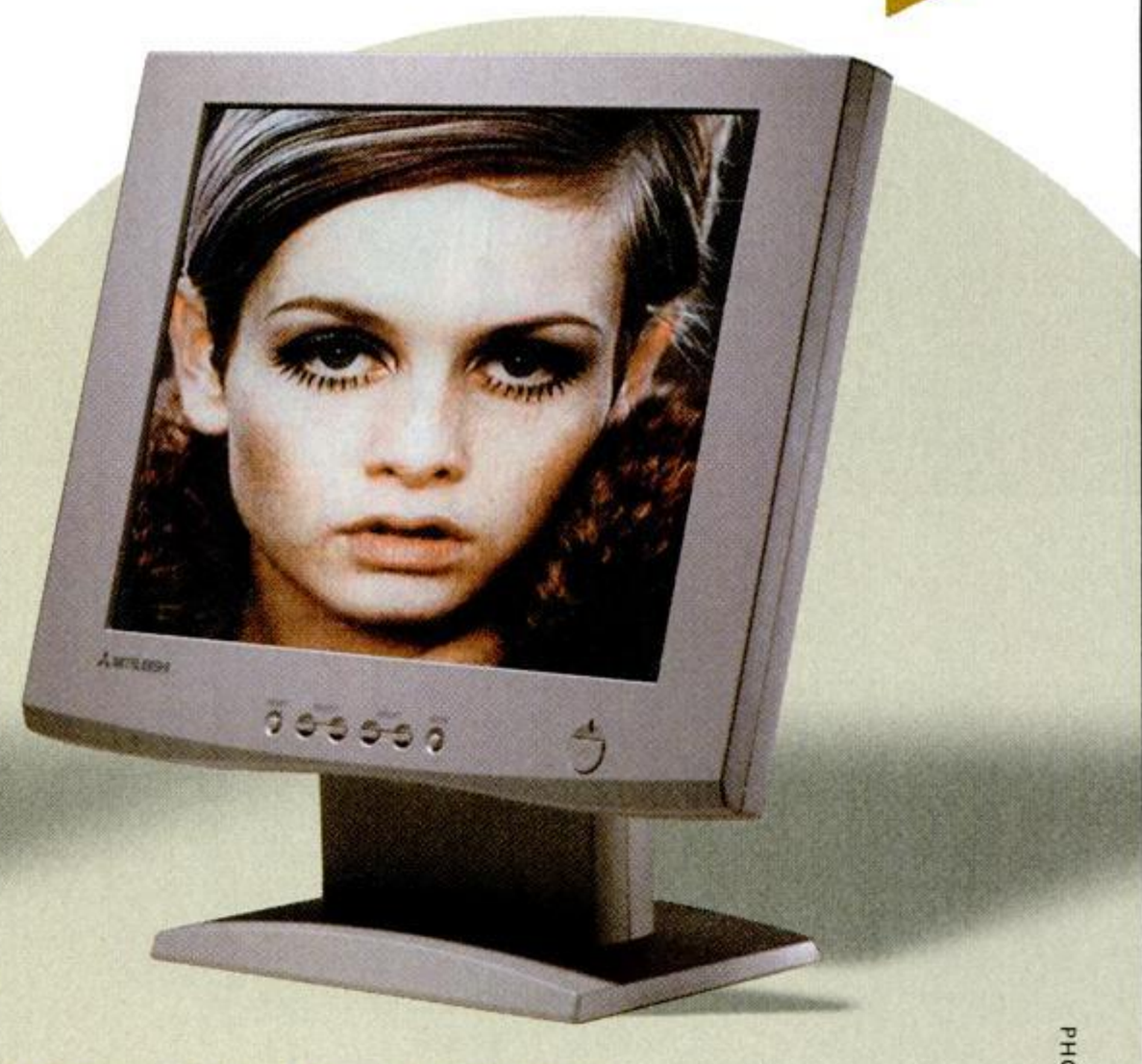

► Mitsubishi LCD50

Despite four stuck pixels—including two adjacent, which violates some manufacturers' stuck-pixel policies—the LCD50 is a compelling panel. The 15-incher boasts excellent photographic image display, with bright, evenly saturated colors. RGB channel controls are available to adjust color balance.

The LCD50 is the only panel in this roundup that comes with not only a brightness control, but also a black-level control. At its factory preset, the LCD50 had trouble displaying the black end of the grayscale. On the white end, light grays displayed well against a pure white background. Adjusting the black-level control from 50 to 100 brought out all the dark grays one would see on a CRT monitor. This setting, however, also adversely affected white-end grayscaling. Eventually, we were able to find an acceptable compromise at a black-level setting of 83, all without having to adjust the contrast control, which would have had a much more punitive effect on overall image quality.

At its factory preset, the panel displayed a considerable amount of pixel noise, but we reduced it to insignificant levels with the phase control, making for nice text presentation. With better grayscaling and zero stuck pixels, the LCD50 would be kick ass.

MAXIMUM PC VERDICT

Price $1,400
Company Mitsubishi
Phone 800.843.2515
URL www.mitsubishi.com

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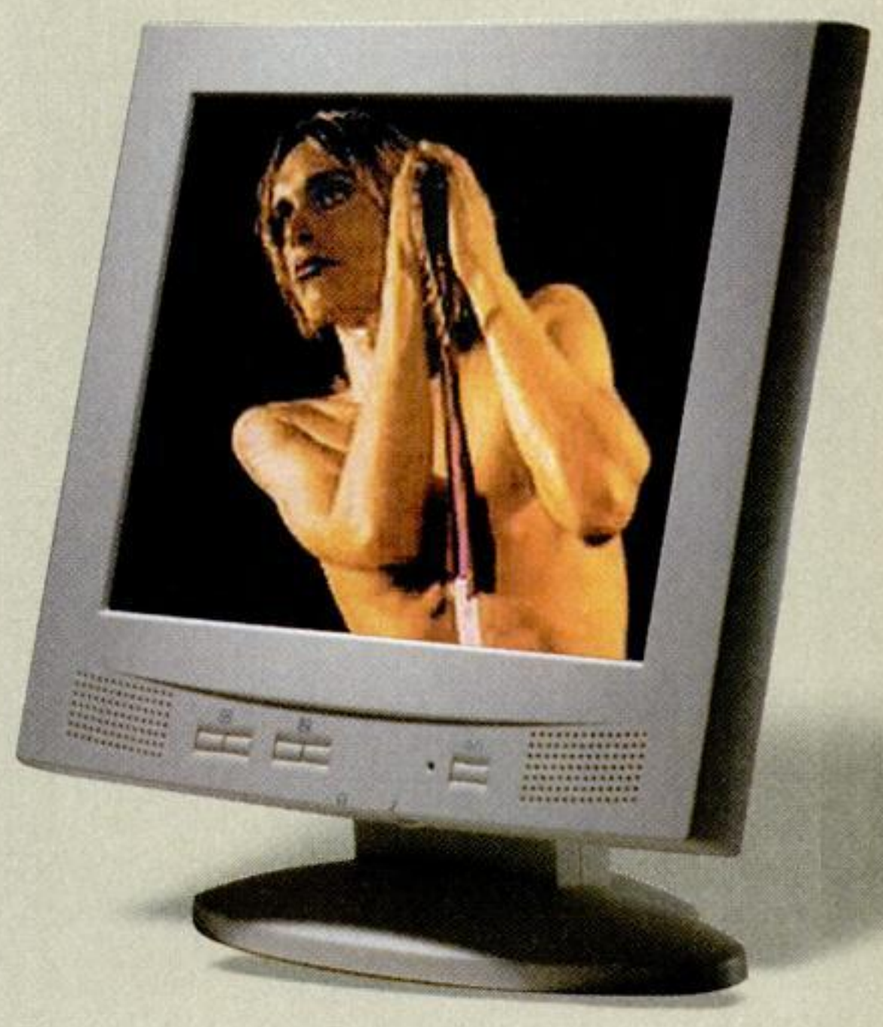
Dare to Compare: Flat-Panel Showdown

MONITOR	VERDICT	PRICE	VIEWABLE*	DIMENSIONS**	INTERFACE
Compaq TFT500	9/Kick-Ass	$1,200	15"	15 • 12¼ • 3	analog
Hitachi DT3140	9	$1,400	14.1"	14½ • 1₁½ • 3¾	analog
EIZO FlexScan L66	8	$3,600	18"	16¾ • 14½ • 3½	analog
Mitsubishi LCD50	8	$1,400	15"	15½ • 12 • 2¼	analog
Princeton DPP 500	8	$970	14"	14½ • 14¼ • 1¾	digital
Samsung SyncMaster 520TFT	7	$1,476	15"	15¾ • 13¼ • 2½	analog
Panasonic PanaFlat LC50S	7	$1,700	15"	15 • 12¼ • 3⅛	analog
Sceptre BT15+	6	$1,400	15.1"	15¼ • 13¾ • 2½	analog
MAG InnoVision LT500	5	$1,000	15"	15⅛ • 12 • 1¾	digital
Sony CPD-L150	5	$1,800	15"	15½ • 11¼ • 2¾	analog
iiyama Pro Lite 36	4	$900	14.1"	15¼ • 11¾ • 1⅞	analog

*Diagonal Inches **WxHxD in inches, pedestal not included.



Sceptre BT15+

When defaulting to its factory preset, the BT15+'s pixel tracking is so bad, the display looks like a simmering pot of bouillabaisse. But unlike other panels in this roundup, the Sceptre's phase control can eliminate much of the painful pixel dancing. Too bad other problems are less easily fixed. The BT15+ had two stuck pixels, significant ghosting, and extremely poor, dark grayscale reproduction. In a test screen of 20 different gray blocks sitting atop a black background, only the nine lightest blocks were visible (19 blocks appeared on our control CRT). The contrast control couldn't address the problem. And while most of the grays ramped nicely with little banding in *DisplayMate's* 256-gray gradient, the darkest grays appeared as a solid chunk and then abruptly shifted to proper grading. Worst of all, however, were the two bands of darkened pixels that ran from top to bottom on the left-hand side of screen. We'll assume the bands are a random TFT defect.

The BT15+ is an unexciting panel destined for word-processing chores—while text appeared sharp, the display lacked brilliance and good image reproduction. It seems Sceptre simply grabbed a 15.1-inch Hosiden TFT and slapped some plastic around it. The panel's speakers and headphone jack might be its sexiest features.

MAXIMUM PC VERDICT

Price $1,400
Company Sceptre
Phone 800.788.2878
URL www.sceptre.com

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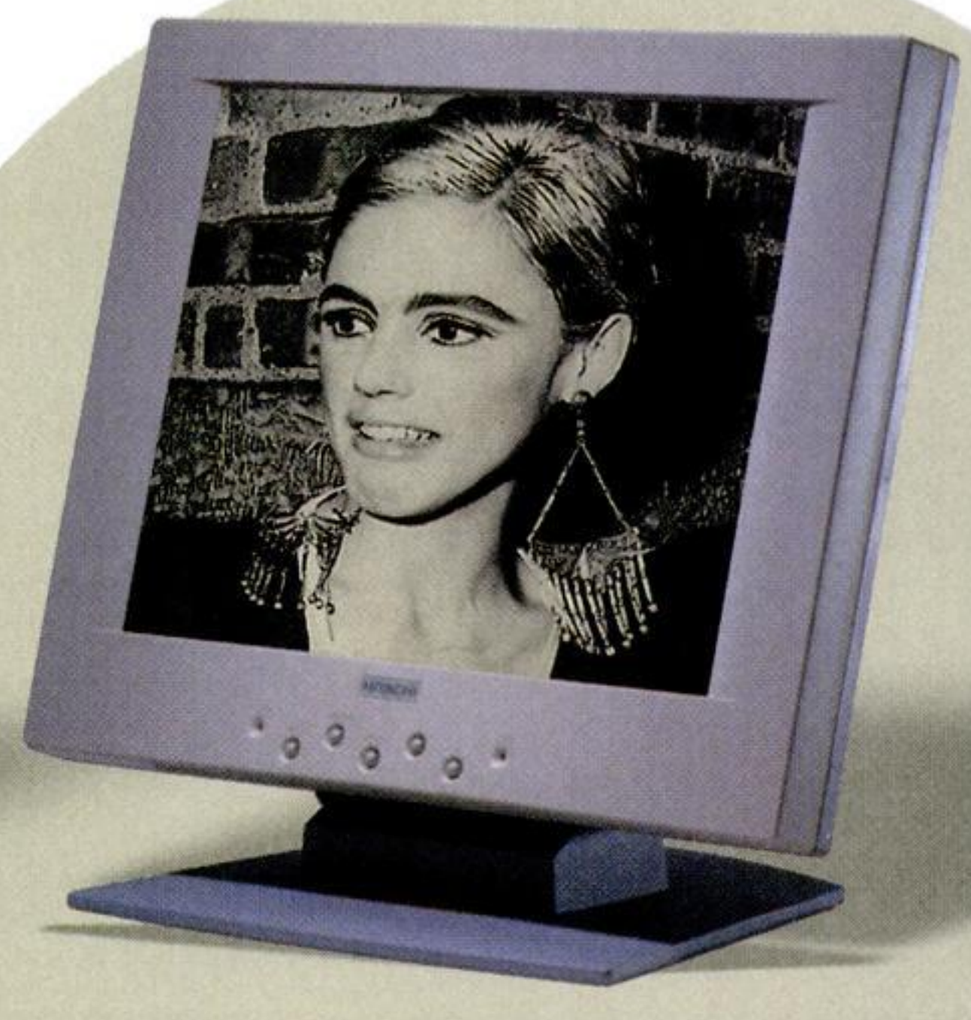

Hitachi DT3140

Ah, the peaceful serenity of excellent pixel tracking. This 14.1-inch beauty exhibited almost no visual noise whatsoever, producing crisp text you could stare at for hours on end. You'd almost swear the DT3140 was using a pure digital interface. Grayscale reproduction was also terrific. The 256-gray gradient test revealed perfect ramping with almost imperceptible banding between steps. Even color reproduction hit CRT quality. *DisplayMate's* Color Scale test—in which 10 colors are displayed in 25 steps from pure black to maximum color intensity—revealed 250 distinct blocks. Other panels in this roundup failed to show color values that bordered on pure black, while still others couldn't generate distinct blocks on the high-intensity end.

Great on-screen controls, including settings for phase, clock, and RGB values, make the DT3140 a near flawless panel (and the model we reviewed came with zero stuck pixels!). Only one problem, significant ghosting, denies this panel the coveted 10 verdict. In areas of high-contrast, visible streaks extend from blocks of solid colors—a real pisser if you're using your panel to display bar graphs. The ghosting is hardly a deal-breaker, though, so we endorse the DT3140 and eagerly wait for larger Hitachi panels.

MAXIMUM PC VERDICT

Price $1,400
Company Hitachi
Phone 800.441.4832
URL www.hitachi.com

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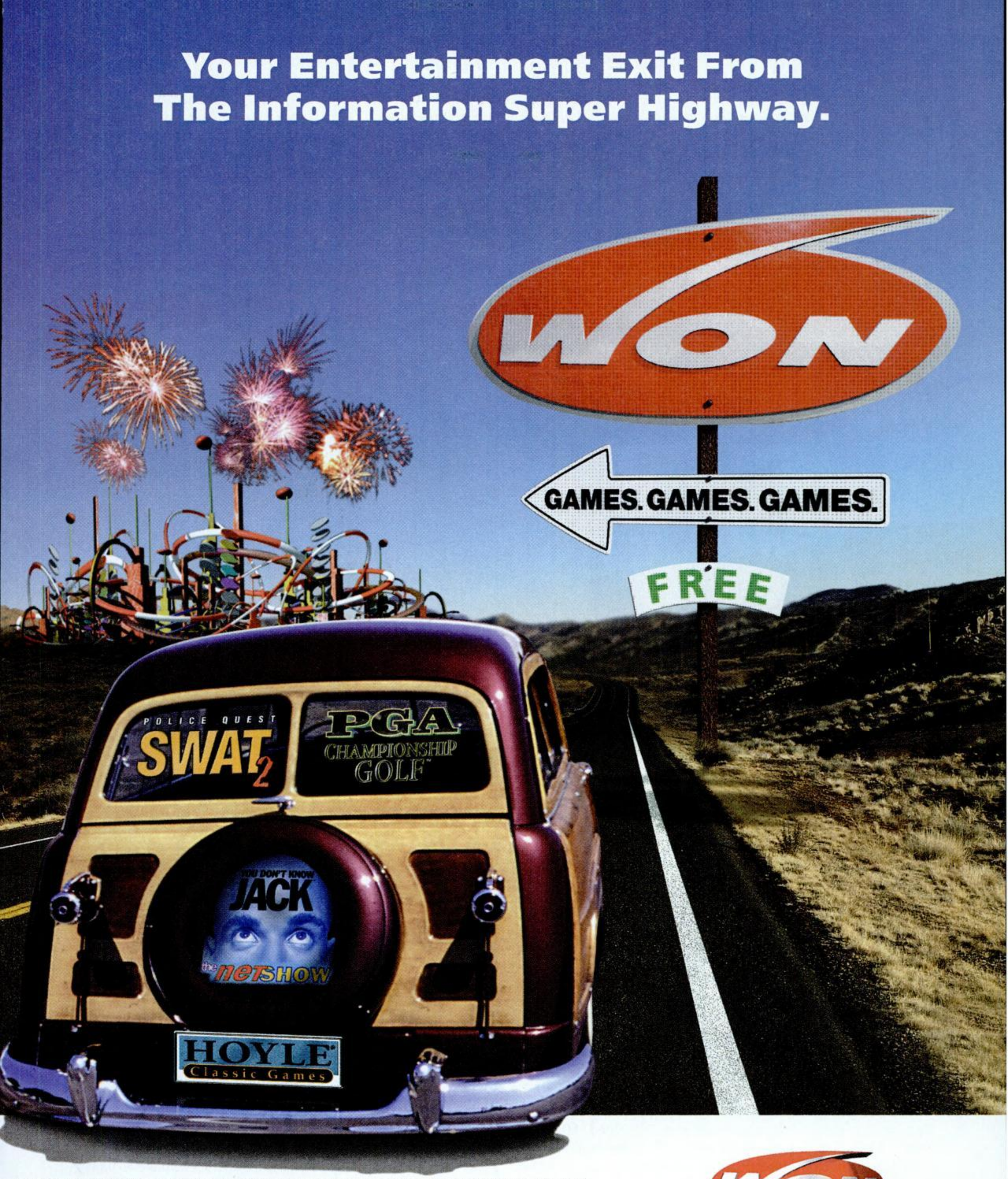

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splitter box let us simultaneously pipe the same *DisplayMate* test screens through five different panels and one Sony Trinitron control CRT—a great way to uncover each panel's unique strengths and weaknesses. Videocard quality can significantly effect final display quality, so we went with the best 2D card around, the 16MB Matrox Millennium G200. Two flat panels we reviewed came with their own pure-digital videocards; we were unable to simultaneously benchmark these panels with the Extron splitter.

After *DisplayMate* testing, we observed how well each panel displayed text and 24-bit color images. We also tested each panel during different times of the day—TFT performance can change dramatically during just a few hours.

When you're evaluating flat panels yourself, look at desktop icons and window borders for any type of noise caused by poor pixel tracking. If you find fuzz, look for on-screen controls that adjust "clock," "phase," or "digital conversion." You should also open a *WordPad* file to determine text quality. In a best-case shopping scenario, you'll bring along your own lush color images and grayscale ramps to determine the panel's color capacity. And before you take any panel home, plug it in so you can count stuck pixels. Visual quality is subjective; there's no single "correct" way for a panel to look. Ultimately, you can only please yourself, so make sure to buy the panel that looks best in your eyes. And of course it doesn't hurt if it looks like a prop from *The Fifth Element*. ✹

Sony CPD-L150

While Sony makes some of the prettiest CRT monitors you'll ever see, its 15-inch L150 is fraught with sickening pixel noise. When we hit auto-adjust, the panel corralled the noise on the right-hand side of the screen, ensuring that the unstable pixels wouldn't turn our left-aligned Windows icons into strobe lights. But we wanted elimination, not containment. Tweaking the on-screen phase and pitch controls couldn't fix the problem—we could only reposition where the noise was concentrated. While some conversion problems are to be expected, the L150 passed our acceptability limit.

The L150 is an otherwise good display, exhibiting zero ghosting, excellent grayscaling, and consistent color saturation. We also liked the controls for setting color temperature and RGB values. Hell, even text reproduction was nice and sharp—just as long as we situated our word processor window on the left-hand side of the screen, and typed from left to right in the western tradition. Because Sony doesn't manufacturer its own TFTs (the L150 uses a Sharp), it may not have much of a research investment in fine-tuning the technology. We hope the company's next flat panel will use an all-digital interface and history will remember the L150 as an early mistake. Yes, the indelible pixel noise is that bad.

MAXIMUM PC VERDICT

Price $1,800
Company Sony
Phone 800.635.7669
URL www.ita.sel.sony.com

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MAG InnoVision LT500

Thanks to a pivot arm and bundled software, the 15-inch LT500 can display in either landscape or portrait mode with the touch of a button. And you have to like the clean, all-digital interface, care of the bundled Trident videocard. Text looked flawless, just like the output from the Princeton panel.

Unfortunately, just like the Princeton Panel, the LT500 comes with just a lonely little brightness adjustment (strangely the plastic chassis features two extra buttons that do nothing whatsoever). Grayscale reproduction was woefully deficient on the white end of the spectrum, so a contrast or black-level control would have come in mighty handy—but no on-screen controls for you! Even worse, the LT500 cannot produce 16-bit color. Its palette falls somewhere between 8- and 16-bit, generating awful banding and dithering. The display is unacceptable if you're looking for a CRT replacement.

It's easy to draw comparisons between the LT500 and Princeton DPP 500: Both use digital interfaces and lack important controls. The Princeton, however, comes with an AGP 3D accelerator videocard and achieves 16-bit color, while the LT500 is bundled with a PCI card and laughs 16-bit color in the eye. We give the nod to the Princeton—despite the LT500's extra inch and pivot arm.

MAXIMUM PC VERDICT

Price $1,000 (with card)
Company MAG InnoVision
Phone 800.827.3998
URL www.maginnovision.com

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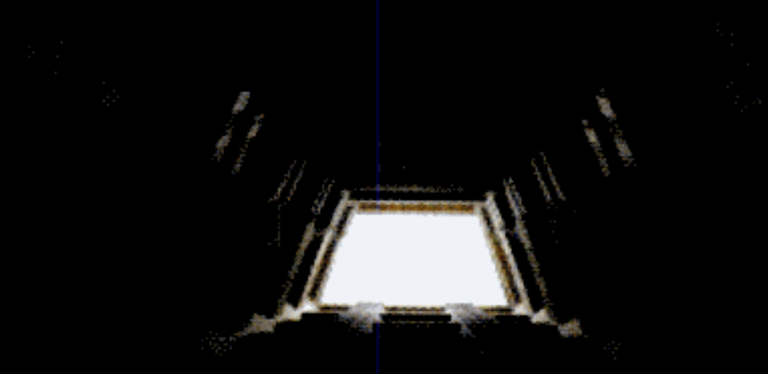

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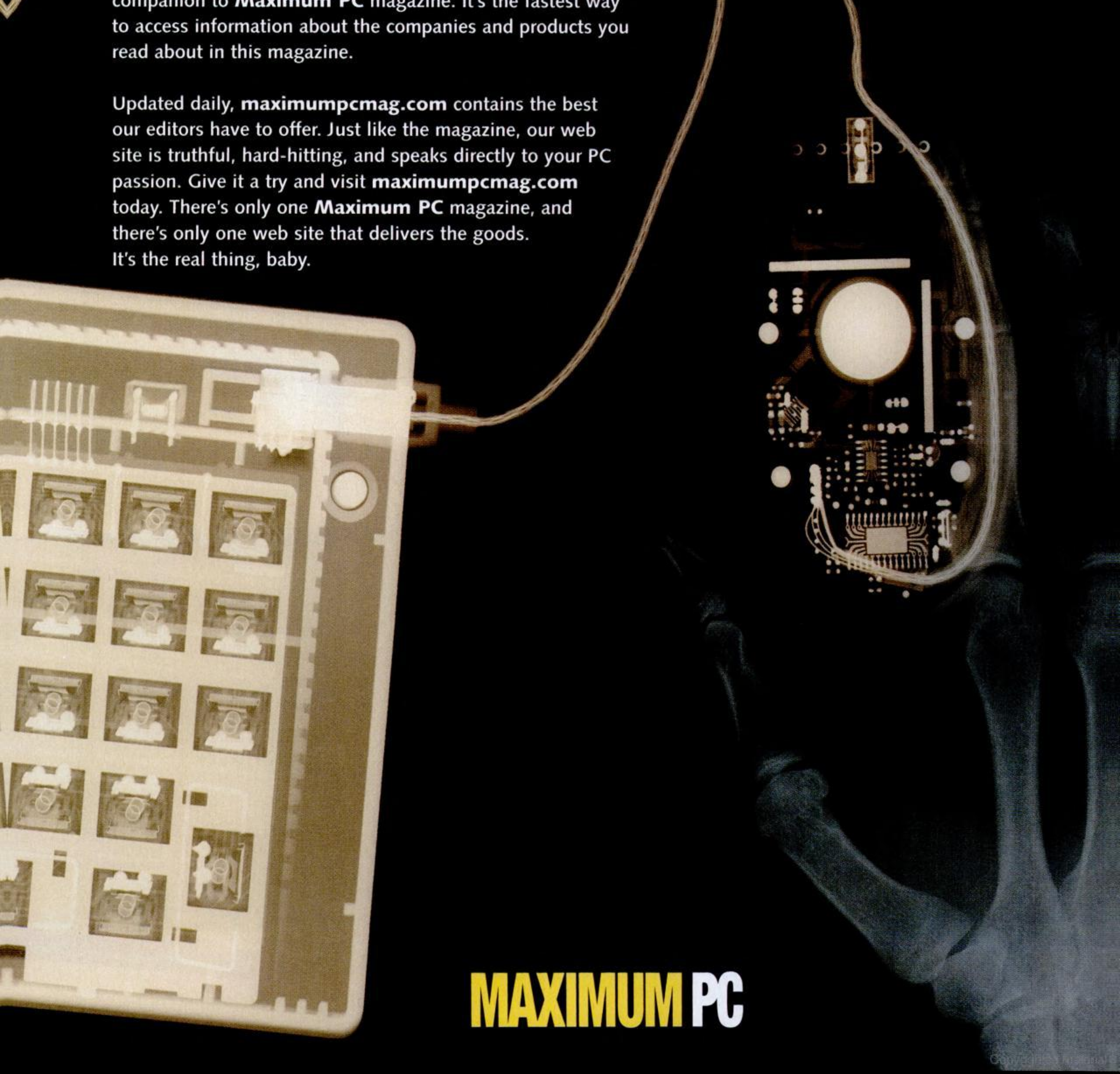

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A Supplement to Maximum PC Magazine boot September 1998

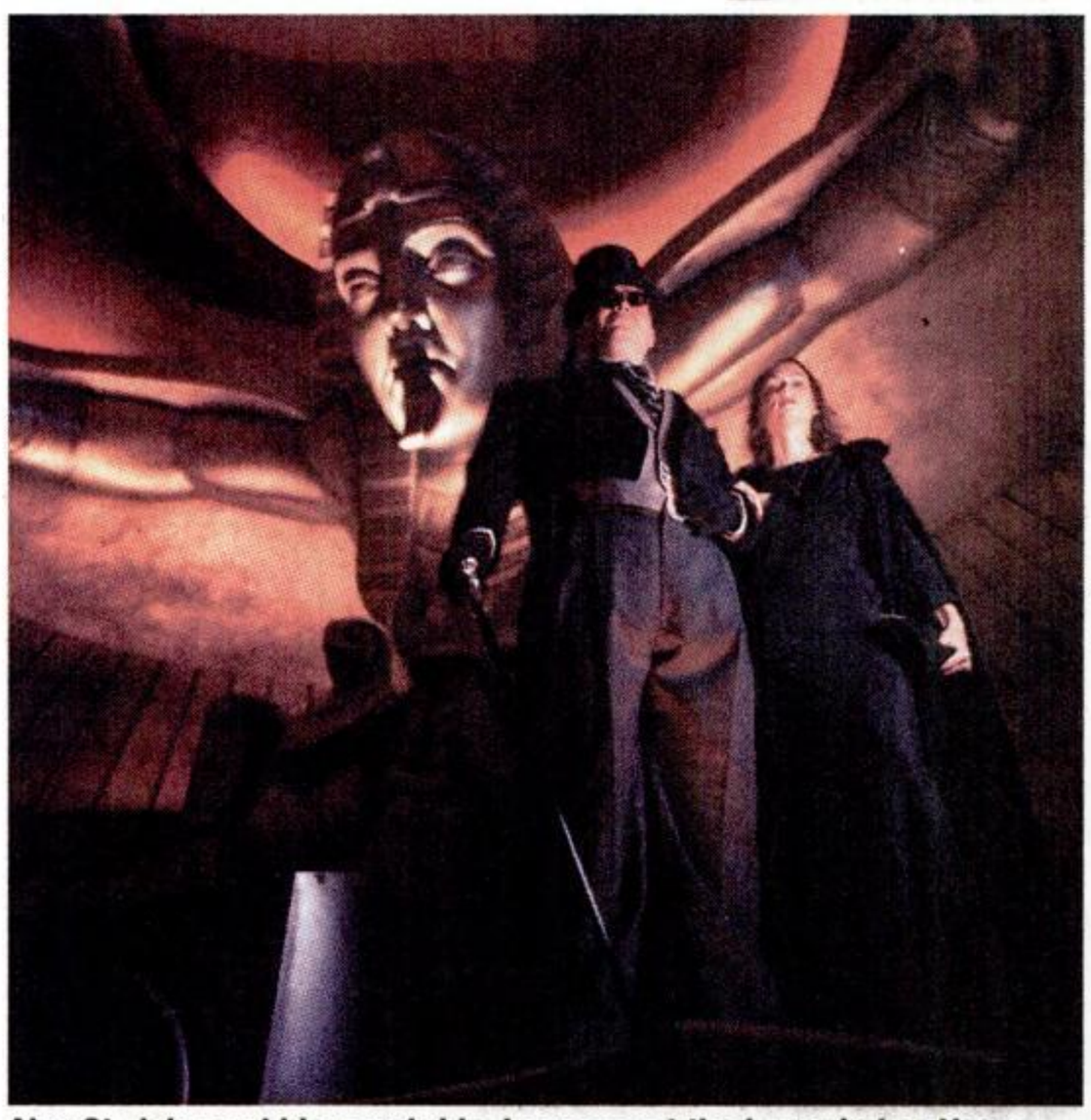
boot REPORT

INSIDE TECH FOR ADVANCED PC OWNERS

DirectX 6 White Paper

Since the first release of DirectX in 1995, Microsoft has updated it more than yearly, and the August 7 release of DirectX 6.0 was right on time. Currently about 50% of all retail Windows applications use DirectX. It's integral to games, Internet Explorer, and Windows itself. DirectX is responsible for the migration of thousands of DOS developers to the Windows platform. No longer a small family of low-level driver APIs, it has swelled over the years to encompass a much broader range of features than those required just for games.

—Alex St. John



Alex St. John and his new bride Jeaneane at the Luxor in Las Vegas.

DirectX is composed of several layers, with the lowest one closely tied to the hardware and subsequent layers evolving upward in abstraction and specialization, ultimately branching into several casually related multimedia components.

The lowest layer and core of DirectX is the original family of DirectX driver APIs: DirectInput, DirectSound, DirectDraw, and the DirectPlay Service Provider. These, plus Direct3D and DirectMusic, introduced in DirectX 6.0, comprise what is known as the DirectX Foundation.

The DirectX Foundation can be split into two layers: DirectX drivers and DirectX APIs (Application Programming Interface). DirectX drivers are designed to hide subtle differences in hardware while exposing functionality to developers. For example, all videocards have memory, but different cards access memory in different ways. Developers want to be able to treat memory like one contiguous chunk and don't care how it's organized by the hardware, so DirectDraw drivers hide hardware anomalies from application developers, making development easier, since varying hardware types are treated in a similar manner.

The upper layer of the DirectX Foundation is the API that exposes hardware to developers. The Foundation APIs are the most "direct" way to the hardware, mapping very closely to how the hardware works. Game developers coding to DirectX Foundation APIs accept responsibility for dealing with the complexities of managing low-level resources in exchange for the speed and flexibility of direct hardware control.

Above the DirectX Foundation lies the DirectX Media layer, providing higher-level multimedia services for applications with more abstract needs. The Media APIs include Direct3D Retained Mode, DirectShow, VRML, DirectAnimation, and DirectPlay. While they don't provide the same level of control and performance as the DirectX Foundation APIs, the Media APIs greatly simplify common multimedia development.

The highest branches of the DirectX family are high-level components, such as NetMeeting, VRML 2.0, ActiveMovie, NetShow, and Chromeffects, that not only work through the Media layer, but also frequently call straight down to the Foundation.

DIRECTDRAW

The DirectDraw API is designed to allow developers to directly control the videocard. It exposes and supports all the latest and greatest hardware features to developers in a consistent way. These features include stretching, bit blitting, color correction, overlays, transparency, drawing routines,

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INSIDE

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WHITE PAPER

DirectX

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logical operations, alpha blending, filtering, compression, decompression, video capture, and palette management.

Without DirectDraw, applications are limited by the performance and functionality of Windows' standard drawing routines. To see how DirectDraw works, it helps to visualize your videocard as a chunk of rectangular memory that your monitor looks inside. At its simplest, DirectDraw simply passes a memory pointer to an application and allows it to draw pictures directly onto the memory. DirectDraw also allows the developer to write data directly into memory on the videocard that isn't displayed on the screen, which can't be done with any other Windows API.

A good example of this is page flipping, a technique used in video games to achieve incredible framerates and image clarity—an impossible task in Windows before DirectDraw. To understand page flipping, you need to know how your monitor works. The image on your screen is generated by a single beam scanning horizontally across your screen to illuminate groups of phosphors on the display at rates of 60Hz to 85Hz. When the beam reaches the lower right corner of your screen, it shuts off for a fraction of a second to restart in the upper left corner of the display. This is called vertical blanking.

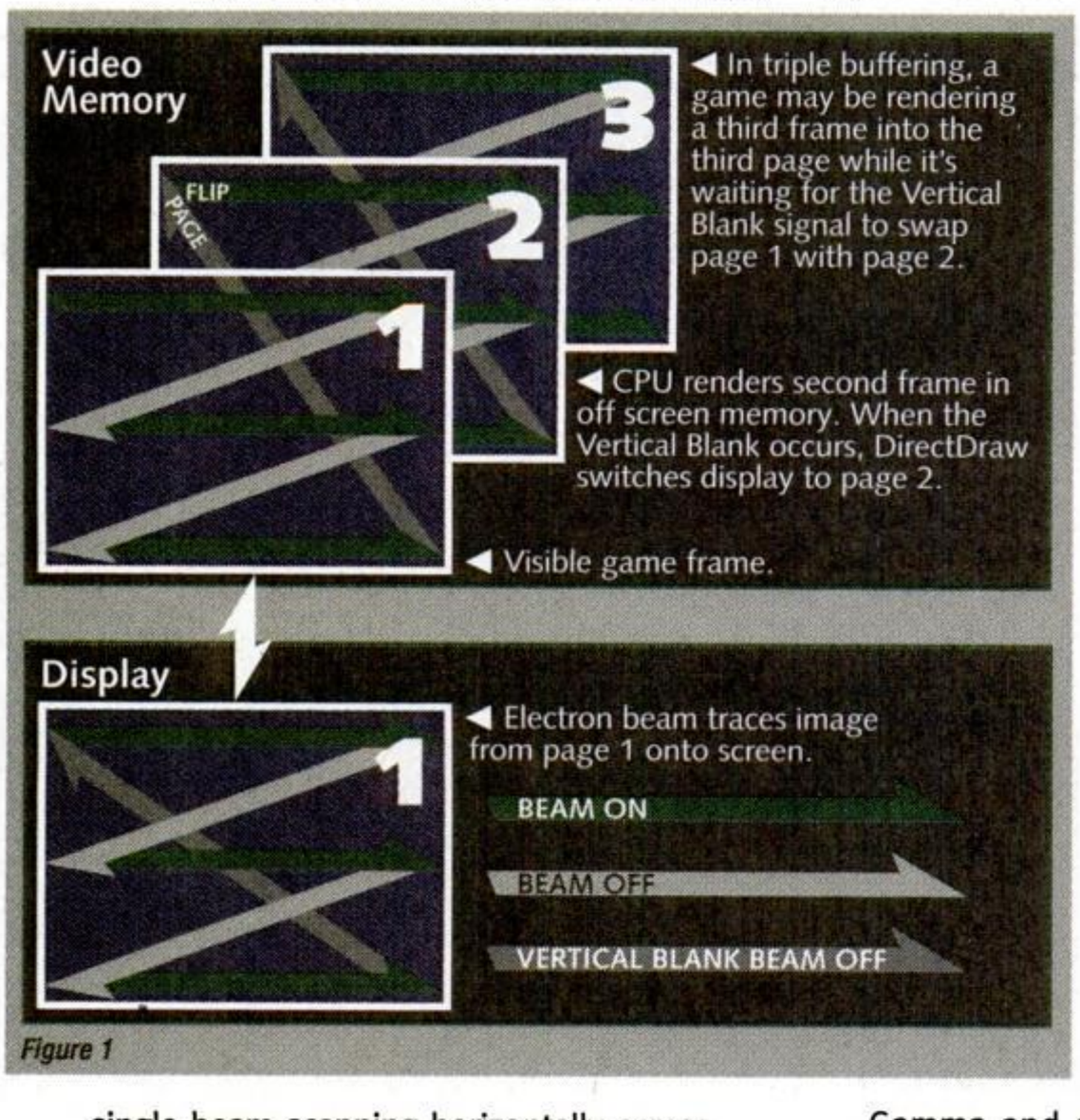

Figure 1

Page flipping works its magic by allowing applications to draw complete new frames in off-screen memory while the videocard displays the current frame in on-screen memory. When the vertical blank occurs, DirectDraw substitutes the new frame for the old, and the display draws the fresh image. This trick allows games and video playback to run dramatically faster and eliminates the tearing that occurs when the image in video memory changes while the beam is active (see Figure 1).

Other uses for off-screen memory include overlays, bitmap storage, and texture memory when 2D and 3D graphics are integrated on the same board. Games can use off-screen memory to store sprites, and then call on the video hardware to slam them together with incredible speed and create 2D smooth scrolling scenes for games like Diablo.

Overlays are a means of compositing images at the signal level. This is the mechanism that 3Dfx Voodoo cards rely on to "inject" 3D graphics into the display on your screen without having access to video memory. Overlays are also typically used for video playback or injecting a television signal onto your display (see Figure 2).

DirectX 6.0 enhances DirectDraw with color correction, data compression, and video ports. Usually video information is piped from the computer to the display, but for video capture, video information comes to the computer from an external source. Video ports put data directly into video memory so the CPU can collect and manage it in realtime.

DirectDraw 6.0 supports compressed data management in video memory to help video playback and aid texture management in conjunction with Direct3D. By using compressed data to carry out bit blitting and rendering operations, videocards can conserve precious video RAM. Applications can also call on video hardware to compress or decompress image data for them—a useful feature for video editing and 3D games.

Gamma and general color correction, long a feature of the Macintosh, has finally arrived on the PC with DirectDraw 6.0. Color correction makes it easier for applications to consistently represent colors across different monitors and printers. It also makes it easier to create simple effects in games, such as tinting the entire screen blood red when you get fragged, that are otherwise computationally expensive. Color correction allows applications to tweak with hue, saturation, contrast, brightness, sharpness, and gamma through hardware.

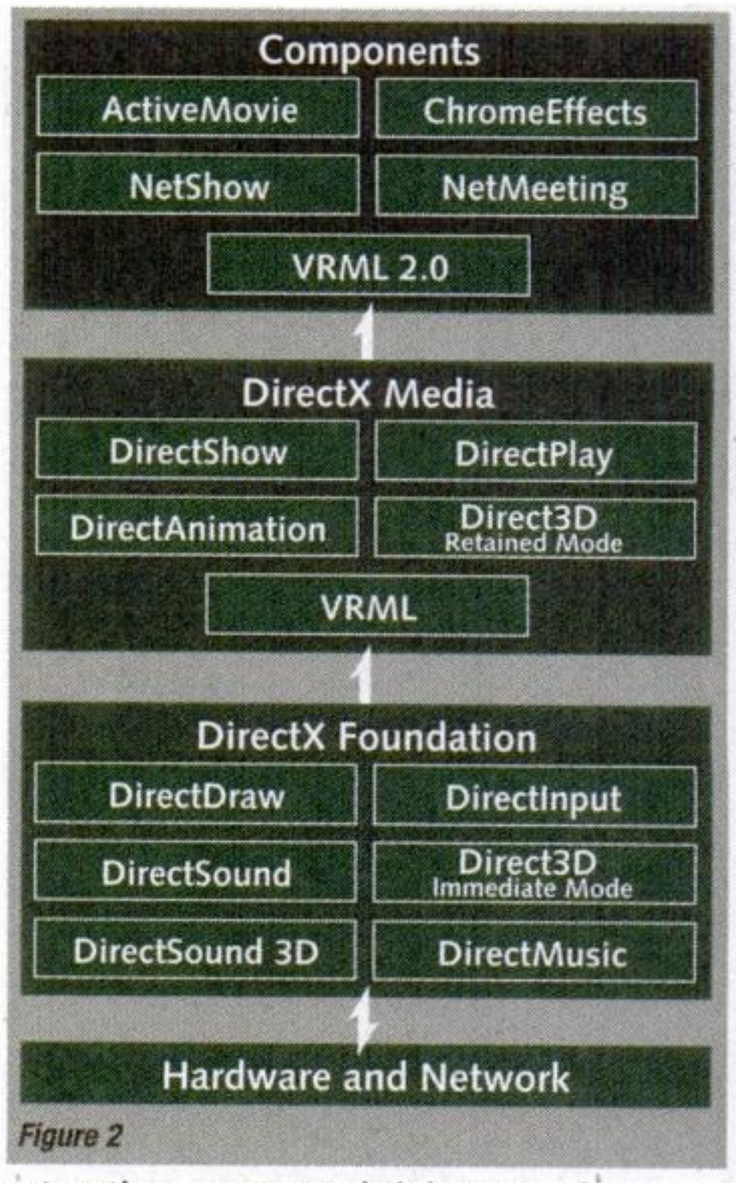

Figure 2

DIRECT3D

Direct3D is really just an extension of DirectDraw, acquiring an independent identity only when used for 3D cards without 2D support. Direct3D handles the task of pumping polygons and texture maps out to the video hardware after the CPU has finished lighting and transforming them (DirectX 7.0 will address 3D hardware acceleration of the lighting and transformation process). Direct3D also works with DirectDraw to manage texture memory on hardware that shares video memory between 2D and 3D graphics.

Direct3D, DirectX's most criticized technology, has taken the largest leap forward in DirectX 6.0. A 60% performance improvement was achieved through general optimization, major improvements were made under the hood to ease programming, and support was added for a more flexible range of vertex data types. New to Direct3D 6.0 is single-pass multiple texture blending, bump mapping, automatic texture cache management, w-buffering, and stencil buffers. Direct3D stencil planes support all the standard OpenGL operations, paving the way for the OGL API to sit comfortably on top of D3D drivers.

DIRECTMUSIC

Operating on message-based musical data, DirectMusic is the missing stepchild of the DirectX family. It addresses Musical Instrument Digital Interface (MIDI) support, long the bane of the PC musician. Released as a "developer preview" in DirectX 6.0, the full version will be part of DirectX 6.1 later this fall.

Music can be synthesized in hardware or in a custom synthesizer, with the DirectMusic Software

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Synthesizer automatically kicking in when hardware wavetable isn't available. It supports downloadable sounds (DLS) and can create a waveform based on a stream of MIDI messages, using instrument timbres synthesized from DLS samples. By default the samples are from the Roland GS collection.

In addition to supporting MIDI and downloadable sounds, DirectMusic has tools for authoring and performing interactive music. Channel grouping allows audio developers to bypass MIDI's 16-channel limits. A generic mechanism loads and performs musical segments, regardless of the performance technology, and multiple pieces of music can be played concurrently with individual timing and instruments.

DirectMusic supports standard MIDI files, interactive music segments, third-party technology, and dynamic playback, allowing composers to create interactive music themes that are generated on-the-fly, never repeat, and respond to program events.

DIRECTSOUND

DirectSound manages mixing, audio capture, 3D positioning, hardware acceleration, and all other aspects of

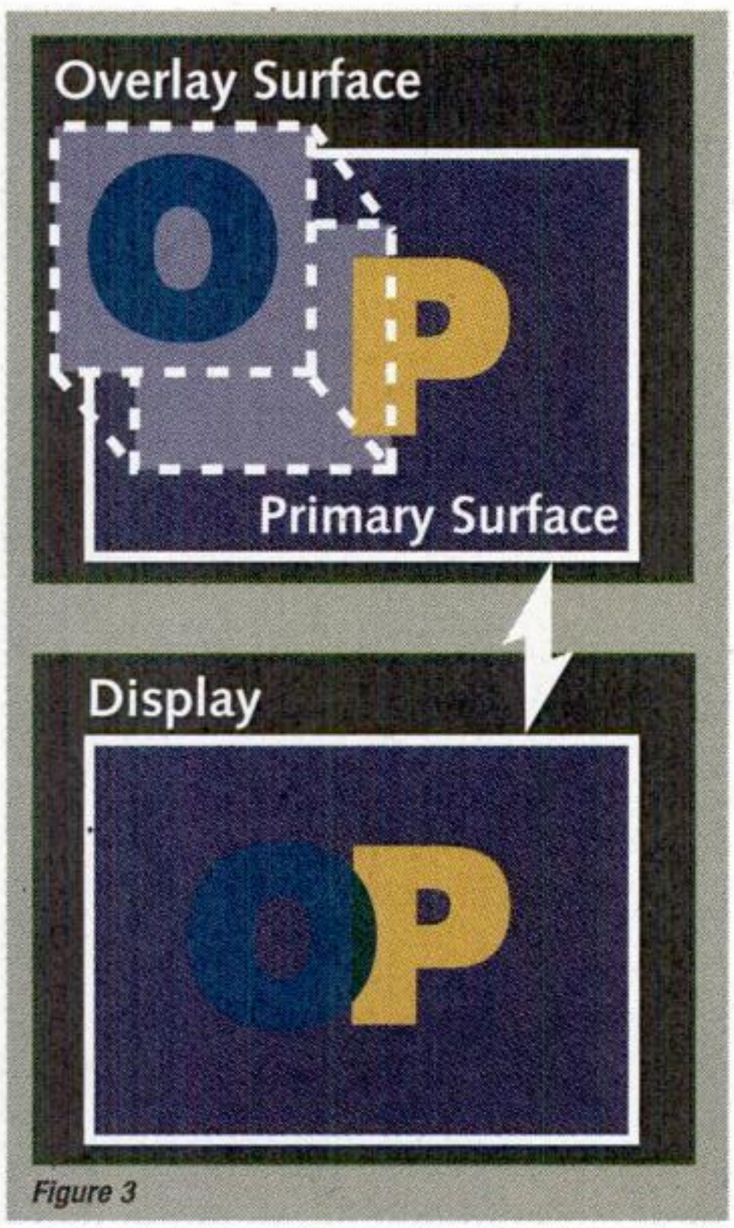

Figure 3

sampled audio playback. It handles the complex task of playing several tracks at once, decompressing sounds, and mixing them all in realtime while applying audio effects. It hasn't changed much since DirectX 5.0, which introduced 3D positional audio support.

DirectSound works alongside Direct3D to make it easier to create *realistic 3D audio* in a virtual environment. When sound and video are processed on the same board, DirectSound works with DirectDraw for cooperative memory management. The new version of DirectSound mixes audio channels up to two-and-a-half times faster than its preceding version.

DSOUND VS. DMUSIC

Most games today use digital sampling, since standards for MIDI support didn't exist under DOS, and Windows was incredibly inept at it. The only way to have exact control of music in a game was to use digitally sampled audio. Think of the difference between sampled audio and synthesized audio as similar to the difference between a bitmap image and a vector drawing. Like vector drawings, synthesized audio is more compact, easier to manage, and easier to download over the net. Microsoft licensed Roland's sound libraries so that it's now possible for synthesized audio to sound the same across a variety of soundcards. With the introduction of DirectMusic, synthesized audio is ready to make a comeback in games.

DIRECTINPUT

DirectInput, Microsoft's API for controlling joysticks, mice, keyboards, steering wheels, and other input devices hasn't changed much since the introduction of force-feedback support in DirectX 5.0. The subtlest, but perhaps most important, contribution made to gaming by DirectInput is DirectMouse and DirectKeyboard. The Windows messaging architecture is notoriously slow, and makes the keyboard and mouse response times feel like they're covered in molasses. DirectInput drills a hole down to the lowest-level system services, completely bypassing the antiquated messaging architecture to get snappy performance.

DIRECTPLAY

DirectPlay is a little-talked-about API that delivers tremendous advantages when it comes to networking

continued on page B8

In Defense of DirectX

Although developers often criticize DirectX for its complexity, it has many powerful advantages:

► **DIRECTX MANAGES RESOURCE SHARING BETWEEN APPLICATIONS.**
For a full-screen game such as Motocross Madness this may seem unimportant, but the Windows user frequently has background applications trying to display things on the screen, take input, and consume resources. Hardware APIs and drivers that aren't integrated with Windows often break because they can't communicate what they're doing to the OS, and thus trip over other applications and system services using the hardware.

► **DIRECTX REGULATES RESOURCE SHARING AMONG HARDWARE TYPES.**
PC hardware evolves quickly, often along several architectural paths. For example, a 3Dfx Voodoo^2 is a stand-alone 3D accelerator without 2D VGA, nVidia's Riva 128 is both a 2D and 3D accelerator, AMD's 3DNow! adds 3D acceleration to the CPU itself, and Cyrix's MediaGX integrates 2D video, audio, MPEG playback, and joystick input into the CPU. These solutions may share memory and computing resources with other services, or they may not. DirectX can hide many of these disparities by emulating resource sharing in software where it doesn't exist in hardware. Thus nVidia can write a Direct3D and DirectDraw driver that shares video memory with texture memory, while 3Dfx can write just a Direct3D driver that co-exists with another card's 2D driver. With DirectX regulating hardware in this way, the introduction of a new kind of 3D hardware acceleration such as AMD's 3DNow! CPU extensions doesn't require thousands of developers to rewrite their games to take advantage of it.

► **DIRECTX MANAGES DRIVER UPGRADES.**
One of the biggest support headaches results from conflicts between driver versions and architectures. The DirectX driver model and the DirectX installer work together to ensure that the most current or trusted driver is always used by applications. Most headaches arise from hardware vendors shipping incorrectly versioned drivers and hardware. Another catastrophe (which DirectX strives to minimize) results from several applications using different driver architectures or versions at the same time.

► **DIRECTX IS DESIGNED TO ALWAYS BE BACKWARD COMPATIBLE.**
DirectX uses Microsoft's Common Object Model (COM) to ensure that new generations of DirectX are always backward compatible with older applications. This allows multimedia technology to evolve fluidly while minimizing the chaos associated with breaking older applications.

► **DIRECTX PROVIDES SOFTWARE EMULATION.**
DirectX strives to provide software emulation for every type of hardware functionality it supports. This means that applications running on inadequate hardware may be slow (since they're running through an emulator), but they will work. The emulation layer also smooths over differences between hardware architectures.

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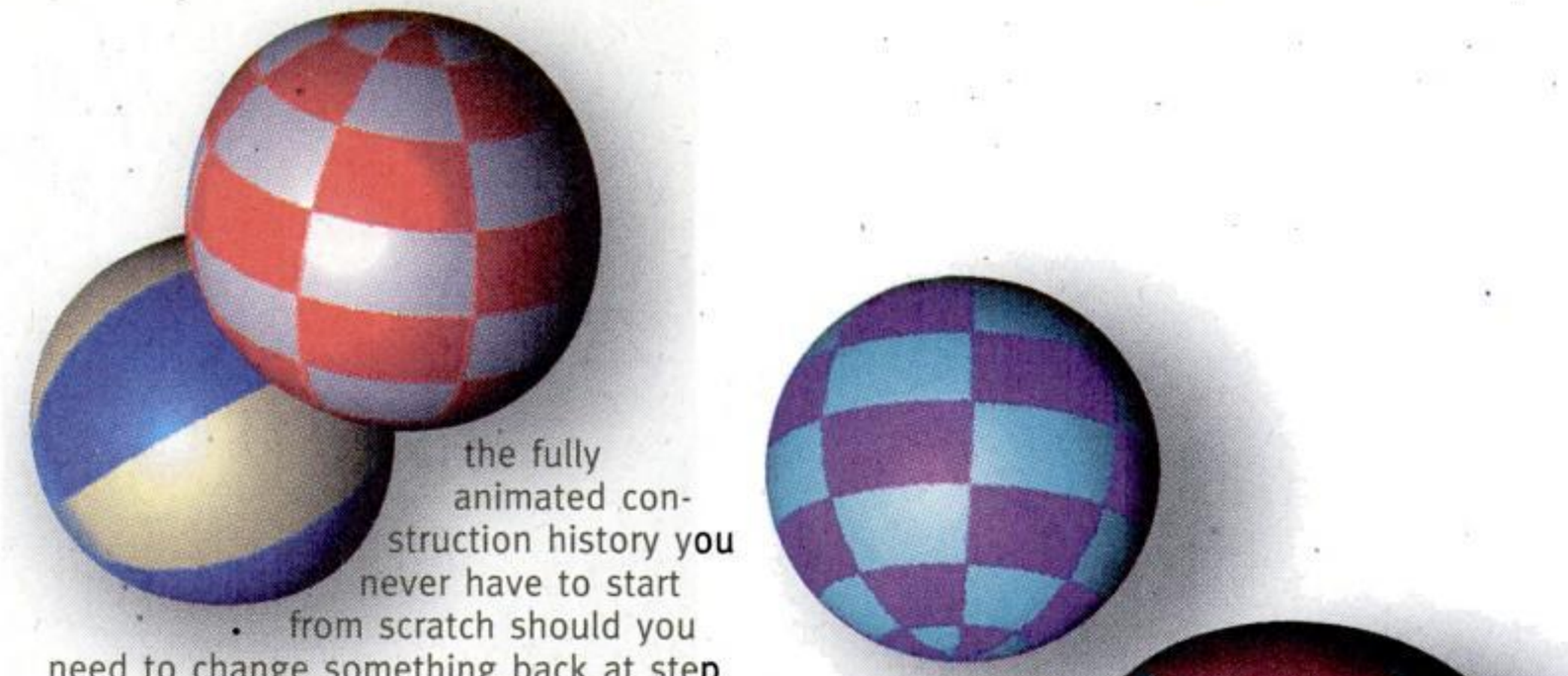
Maya

Tools for 3D minds



boot KICK ASS! PRODUCT

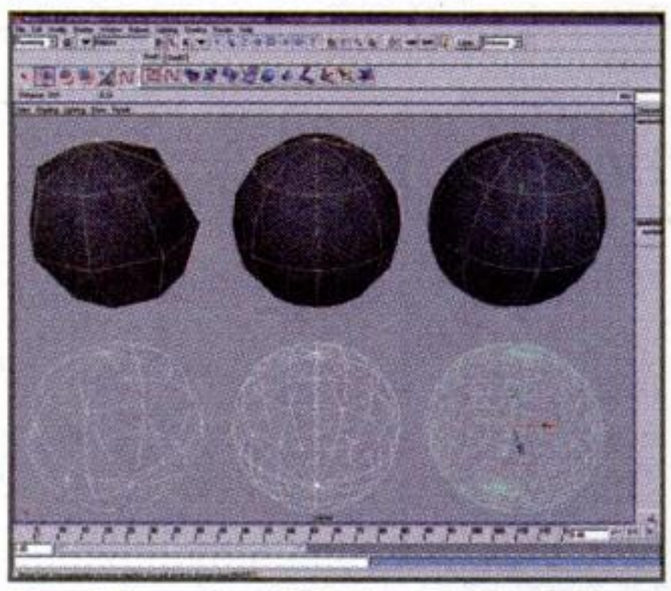
Maya, Alias/Wavefront's newest entry into the high-end animation software market offers multimedia professionals film-quality rendering algorithms, and the ability to seamlessly work in cross-platform environments such as UNIX and NT, features lacking in less expensive applications such as Strata's *Studio Pro 2.5* and Caligari's *trueSpace 4*. Unfortunately, these high-end features come with a price. *Maya*'s $7,500 base module replaces its older sibling, *Power Animator*, an all-inclusive suite of tools that has infiltrated the world's most renowned post-production houses. *Maya* is a different animal—a beast that's been engineered from the ground up, but can be configured to operate and look like *Power Animator*.

CHECKLIST

MAYA

Requirements

Pentium II | 128MB RAM | Windows NT 4.0 | Three-button mouse | 16MB texture RAM | Open GL card



One of the most useful features in Maya is the ability to set level of detail on a per-object basis—low, medium, or high.

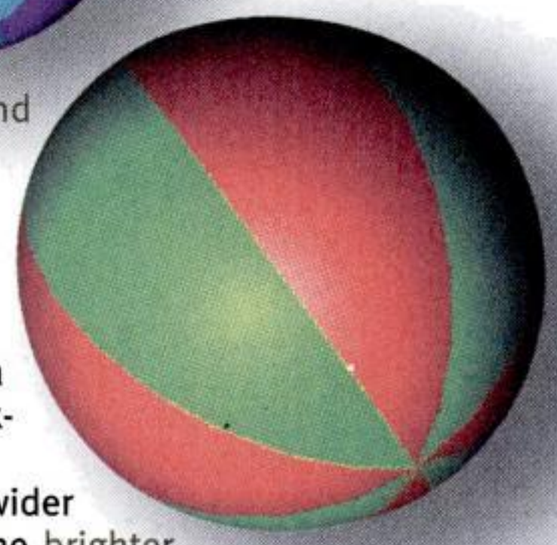
The 10-minute installation of the Windows NT version was painless and straightforward; however, we did have to deal with a pesky dongle and software key.

All commands in *Maya* are quickly available via the Hotbox. When Alias first introduced marking menus to *Power Animator* several versions ago, we didn't see their importance. But they quickly became second nature and tremendously sped up workflow. Instead of using a menu, pulling down a list, and then making a selection, you hold the spacebar down and swipe in one of eight directions to select a command.

Maya's modeler is based on Alias's *Power Animator*, which is without a doubt the best modeler on the market. The power modeling tools such as rounding and surface from four curves were not included, but will be integrated into future versions. While we missed these tools, the powerful NURBS modeler and the polygon tools are first-rate. With the fully animated construction history you never have to start from scratch should you need to change something back at step one. You just make the change, and the results are applied to all the steps in the history. All objects have a construction history, which makes it a snap to go back and add subdivisions or make other modifications such as adding isoparms to a surface to make it react better to a lattice.

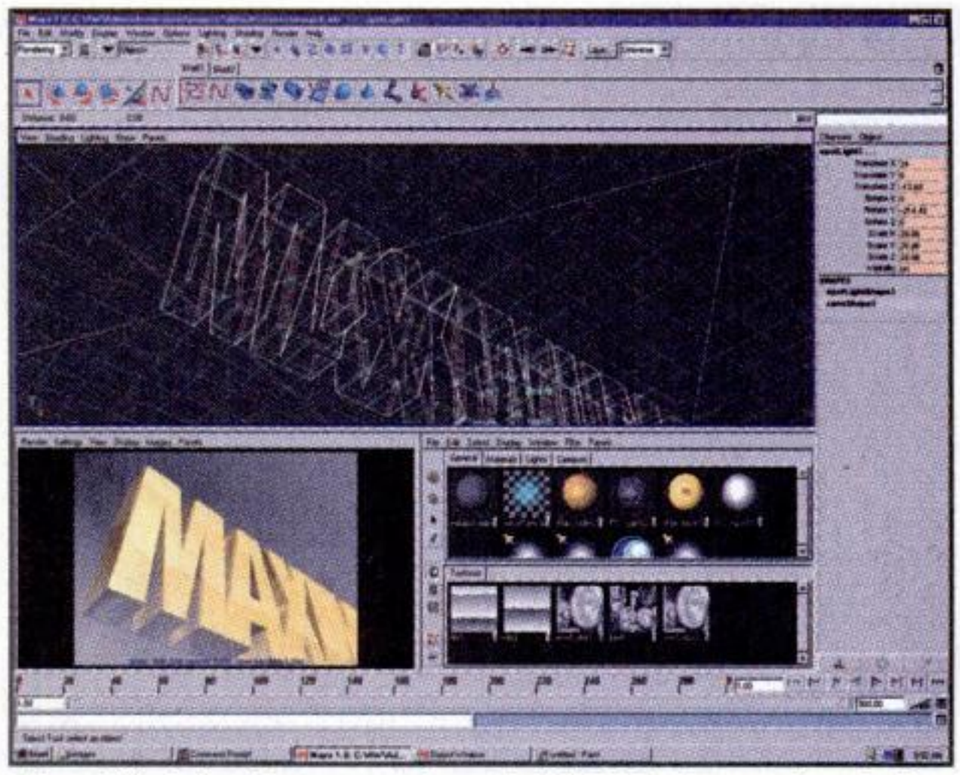
A particularly useful feature is per-object level of detail adjustment. This changes the way the object is displayed, not the actual geometry. So objects in the background, or that are not being worked on, can be set to minimum resolution for display purposes only (not rendering). Another way to keep things orderly when doing large scenes is to use the layer editor. Groups of objects can be assigned to a layer that can be turned on or off. Objects can also be templated so they are visible but locked so nothing can be accidentally modified.

Animation in *Maya* is actually fun. *Maya* uses on-screen manipulators to easily translate, scale, and rotate objects, cameras, and lights in any axis. You can also be more precise by using the channel box and entering numbers manually. Absolutely every numeric value in *Maya* can be animated, such as texture UV placement, light attributes, and material attributes. With expressions, you can write rules that tell objects how to move based on the motion of other objects. For example, using some basic math, you can connect the z-rotation of a wheel on a car to the distance the car moves along the x-axis. Thus you can animate the position of the car, and the tires will rotate perfectly. Or you can connect the intensity of a light to the x-scale of an object. The wider the object, the brighter the light.



Maya also has all of what *Dynamation* had and more. You can add forces to particles and geometry such as gravity, turbulence, wind, air, Newtonian force, and so forth. *Maya*'s particles are the best available. You can easily work with tens of thousands of particles on screen at once and still maintain interactivity. You have infinite control over every possible particle aspect and you can even write your own rules as to how they behave. *Maya* now also has hard and soft body dynamics that let you do physical based animation automatically. You can make a bowling ball and pins, and when the ball hits the pins, they react like they would in reality. No more keyframing. Once you're happy with the simulation, you can bake the animation to create curves that can be edited.

Another cool feature of *Maya* is the ability to adjust the overall time of the animation after you've done all your



The multilister is where you create and edit light, textures, and materials.

For definitions of Terminator words, hyperlink to the back of Maximum PC, or check out the Terminator online at www.maximumpcmag.com.

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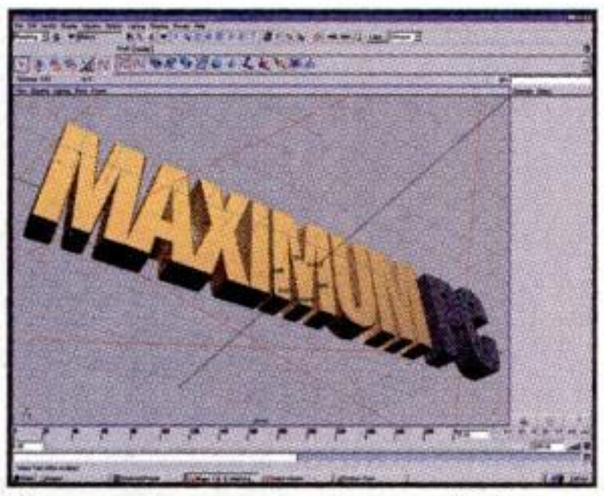
keyframing. If you animate to 20 seconds and then realize it works better as 17 seconds, you just drag the time scale bar at the bottom and everything is adjusted accordingly.

Maya has the rendering power of Alias but also took an important feature from *Dynamation*. With *Dynamation*, you could only do hardware rendering of particles, which was lightening fast but had limited imaging. *Maya* offers both hardware and software rendering. You can render a test animation with the hardware buffer in a matter of minutes, including hardware motion blur. You get to see lighting, texture, and so forth in a fraction of the time. You can interactively see lighting, textures, and transparency in realtime. The feature-packed software rendering is the best available. The included OptiFX features from Alias let you quickly create some amazing lighting effects such as glows and beams.

In the multilister, you create and edit light, textures, and materials. The drag-and-drop feature in the multilister makes adding textures and other effects a snap. Once again, every attribute can be animated over time, or with expressions. Hence, you have so much control at this level that you can easily get lost.



Maya analyzes your hardware and takes advantage of the equipment you're using, for example, manipulating fully detailed models in realtime.

Another important window is the outliner, which lets you see every element in your scene and how things are connected.

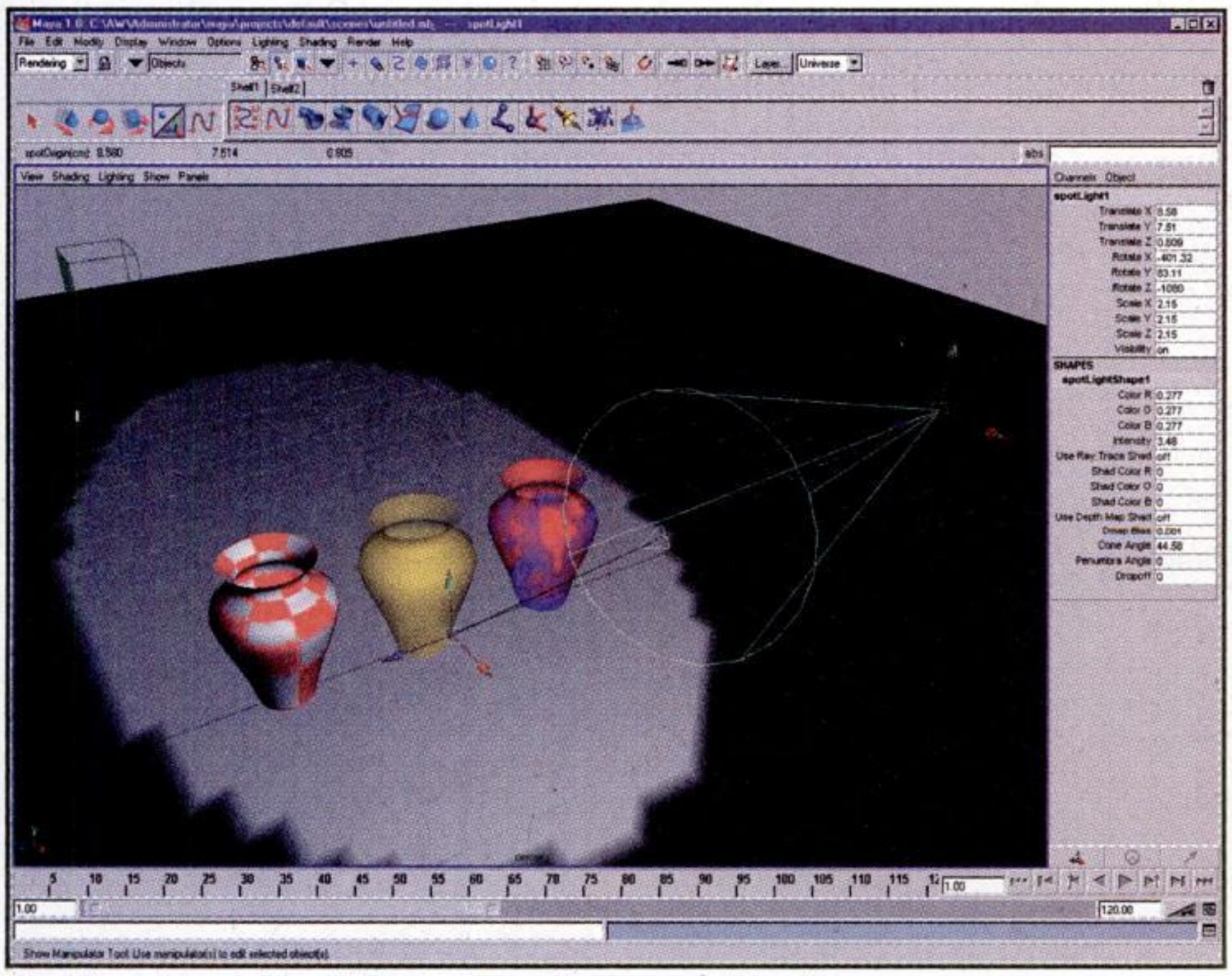
With some software, such as *Softimage*, you are limited to the tools provided, but with *Maya* the sky's the limit. With MEL (*Maya* Embedded Language), you can create custom scripts and tools, add them to your toolbar, and even add your own icons, so if there's something you want to do that *Maya* doesn't offer, you can add it. You can use *Maya* without ever touching MEL, but it's there when you're ready for it.

If you compared *Maya* to a sports car, it would be the Ferrari of animation applications. When you've graduated from applications such as *Studio Pro* or *Ray Dream Studio* and have taken *LightWave* or *3D Studio Max* to the limit, then you'll be ready for *Maya*.

—Alan Kennedy

Price $7,500 base; $6,000 FX; $6,000 Artisan
Company Alias\|Wavefront
Phone 415.362.9181
URL www.aw.sgi.com

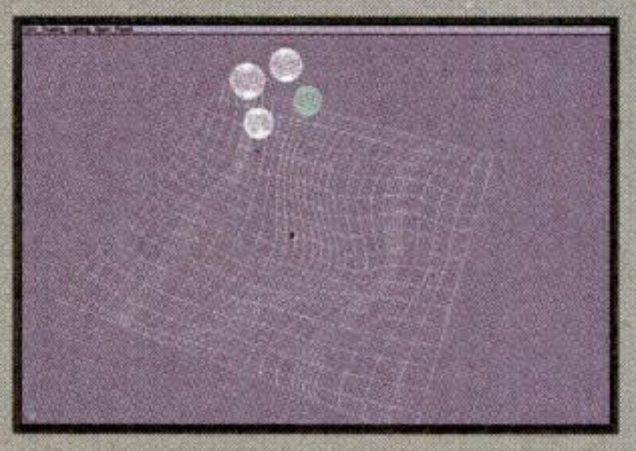
boot verdict 10



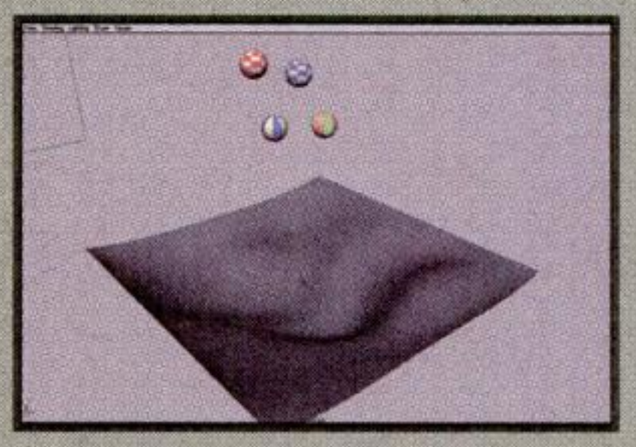
Maya lets you interactively see lighting, textures, and transparency all in realtime.

ANIMATING BOUNCING BALLS

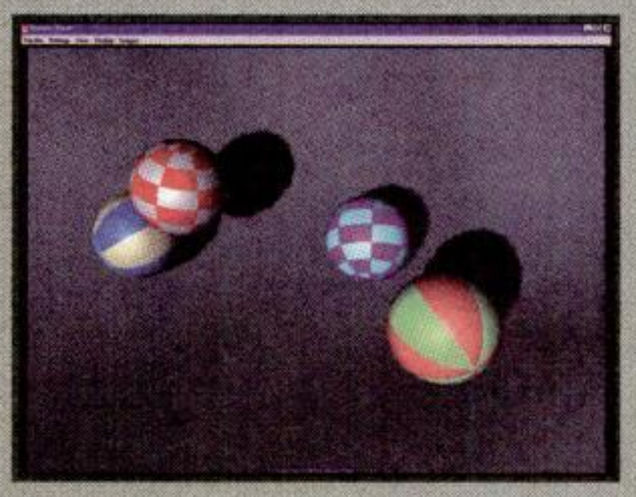
- *Create four or five curves in the side window. They should look like sideways 3's and be approximately the same length. Space out the curves along the x-axis and loft them together to form an irregular surface.*
- *Select the first and last curve, and scale on the y-axis so they are almost flat. Next, translate the two curves up so they form an edge to the surface.*
- *Now create four spheres and translate them above the surface and scatter them around a little at different heights. Add colors and textures to the spheres so they look different.*



- *Select the surface and make it a Passive rigid body. Then select the spheres and make them Active rigid bodies.*



- *With the spheres still selected, add a Gravity field. Select the balls one at a time and with the channel box modify some of the dynamic attributes to give each their own personality. Press play and watch the balls fall, collide, and react with not only the surface but each other as well.*



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Intergraph GX1

Two Xeon procs in a dangerous box

Intergraph's new TDZ 2000 GX1 is the first workstation we've seen with dual 400MHz Xeon processors. The 512K of full-speed cache makes this workstation ideal for NT animators doing visual simulation, virtual reality, CAD, or any cache- or floating-point-intensive application. For a little more money, you can jack the cache up to 2MB. Of course, more cache means more RAM. And with 2MB of cache, the GX1 fully accommodates up to 2GB of ECC SDRAM.

boot KICK-ASS! PRODUCT

Getting into the machine proved tricky. Underneath the top plastic handle is a trigger similar to the lever that unlatches your car's hood. When you find the release catch, pull it up carefully. Two metal vampire fangs dangle threateningly close to the latch. They drew blood twice from our staff.

The GX1 employs two videocards. The VX113-GT AGP board has a 16MB frame buffer and 16MB texture buffer. The second card is simply a geometry accelerator capable of handling 1.68 Gigaflops per second.

We dig the four DIMM slots, and that only two were filled with a pair of 64MB ECC SDRAM DIMMS. The machine comes stock with six 5.25-inch drive bays (two free, but you can't get to them unless you yank the procs—not an easy task).

The two half-height 9GB Seagate Cheetah drives laying back-to-back gave us worries about possible heat issues, especially being so close to the Xeons. Intergraph handles the heat by strategically placing two fans inside, one to draw cool air in and one to push the warm air out. While this helps tremendously, in the future we'd like to see at least two more fans.

The 32x CD-ROM came in with a 20x drive rating and read CD, CD-R, and CD-RW media perfectly. But we didn't like the lack of a Zip, Jaz, Syquest, or CD-R drive.

We were disappointed with the Intergraph 21-inch (20-inch viewable) shadow-mask monitor. Shadow-mask technology is good for hard-core CAD design, but we don't recommend it for photo imaging: it lacks the brilliance and color purity of aperture-grille technology. Also, the extremely convex CRT leads to geometric distortion and screen glare. And there was some distortion on the left side of the monitor that we couldn't clean up using degauss or moiré controls.

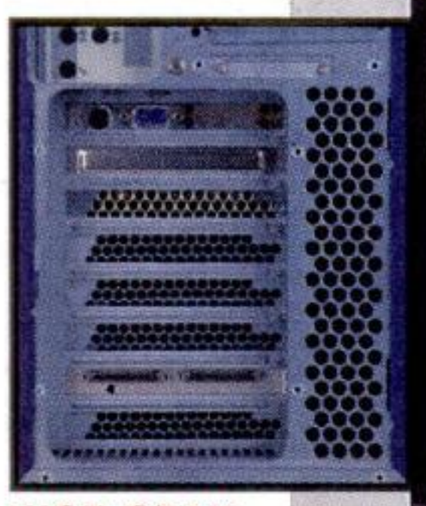
The durable multimedia keyboard sounds adequate at low volumes, but cranking it creates distortion. And the built-in, dated, SRS 3D audio technology causes even more distortion.

If you compare this machine to the TDZ 2000 Intergraph sent to us a year ago, you'll see a dramatic performance increase. Using OpenGL Perf, the TDZ got an 8.48fps score, while the GX1 got 14.23fps. And where last year's *LightWave* test took 829 seconds to render; the GX1 did it in 351. To give you an idea of how much of a speed increase you can expect going from one processor to two, we tested a *LightWave* and *3D Studio Max* scene using one and then two processors. On one proc, *LW* rendered in 606 seconds, on two it rendered in 351. In *Max*, it took 493 seconds using one proc and 253 using two.

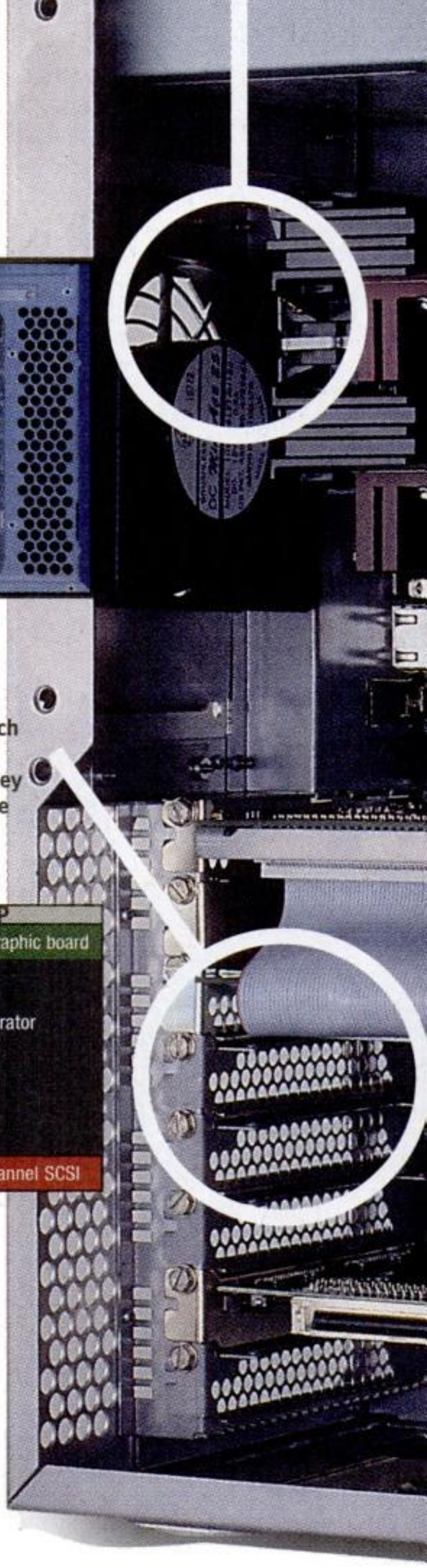
The GX1 is a powerful machine that gives you the speed and power to both pre-visualize and render animation projects on one box. When you add to that Intergraph's sterling service and support, you've got a machine that's worth paying a few more dollars for.

—Rick Popko

OUT WITH THE BAD AIR, IN WITH THE GOOD
To dispel heat from the box, Intergraph uses a two-fan system. One sucks in cool air and the other shoots the warm air out.



JUST STAY COOL
The holes drilled in the expansion slot covers don't do much **to keep dust out of the machine, but** they **help keep the** inside **of the box cool.**



under the hood

THE BRAINS	
CPU	Two 400MHz Intel Pentium II Xeon
L2 Cache	512K Internal
RAM	128MB ECC SDRAM 100MHz 2GB upgradable to 2GB
Motherboard	Intergraph GX1 ATX motherboard
THE BRAWN	
Drive Bays	Six 5.25-inch (two free)
I/O Ports	Two USB, two serial, one parallel, two SCSI
Hard Drive	Two 9GB Seagate Cheetahs
CD/DVD	Sony 32x CD-ROM
Removable	1.44MB floppy
Fax/Modem	10/100BaseT Ethernet on the motherboard
THE BEAUTY	
Videocard	Intergraph VX113-GT AGP with 16MB texture and 16MB frame buffer
Monitor	Intergraph 21-inch (20 visible) with .22mm dot pitch
Res/Refresh	1280x1024
Soundcard	On the motherboard (no joystick port) Crystal
Speaker	Built into keyboard
Keyboard	Intergraph multimedia
Mouse	Three-button mouse

THE BUNDLE None

EXPANSION MAP

AGP	VX113-GT AGP graphic board
PCI	Free
PCI	Geometry accelerator
PCI	Free
PCI	Free
PCI	Free
ISA	Symbios dual channel SCSI

boot	down
1:23	0:20

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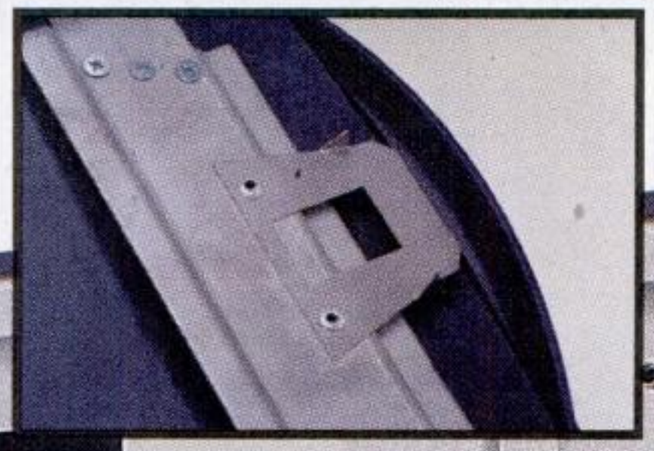
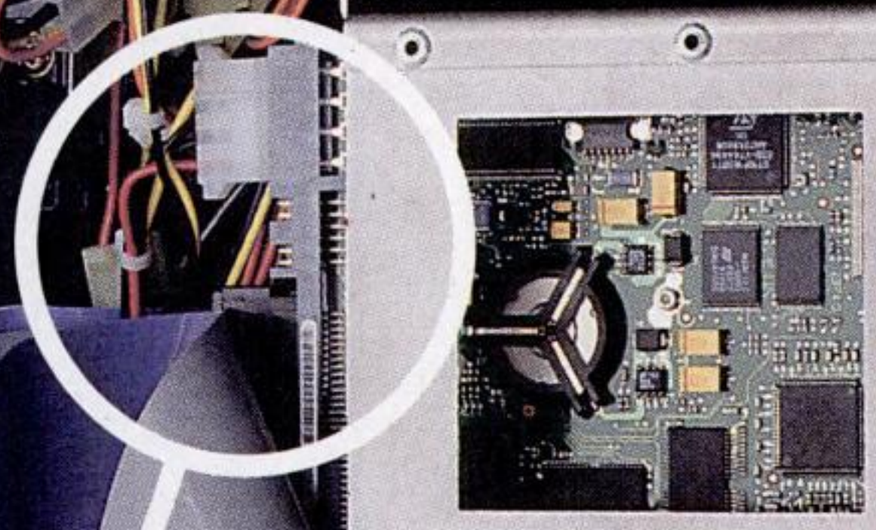


OUT FOR BLOOD
Once you find the catch to pop the top off, be careful when you lift it up. There are two metal teeth close to the trigger that are sharp enough to draw blood.



Intergraph GX1

real-world benchmarking

NT 4.0 APPS *SYSmark for WinNT 4.0*		352
DESKTOP PUBLISHING *Adobe Photoshop 5.0*	K/sec	47.7
HARD DRIVE *HD Tach*	MB/sec	16MB
CD-ROM *CD Tach98*	Drive Rating	20x
LIGHTWAVE 3D V5.5 *Raytrace.lws*	K/sec	351 sec. (2 proc) 606 sec. (1 proc)
3D STUDIO MAX V2.5 *Kyx_rays.max*	K/sec	253 sec. (2 proc) 493 sec. (1 proc)
VIEWPERF/OPENGL *DRV-04 Mean score*	fps	14.23
VIEWPERF/OPENGL *Awadvs-01 Mean Score*	fps	177

The GX1 is the perfect machine for high-end animators ready to ditch their SGIs and make the transition to NT.

⊕	⊖
Plenty of empty full-length PCI slots	No removable media
Awesome dual-proc power	Cheetah drives are too close to each other
Generous disk space	Multimedia keyboard is weak
Expandable docking bay option	No bundled software

Price *$10,999 as tested (single-proc systems start at $4,999*
Company *Intergraph*
Phone *800.763.0242*
URL *www.intergraph.com*

boot verdict 9

OPEN SESAME
To get the case open, the first thing you have to do is take the roof off the machine. However, if you don't know there's a small trigger catch under the grip, you'll find it impossible to pull off.

IS IT ME, OR IS IT GETTING HOT IN HERE?
The two back-to-back Seagate Cheetahs, which are also extremely close to the two Xeon processors, get hot when you're running the machine for hours at a time.

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BACK OF THE BOOT

continued from page B3

Windows. Windows has numerous APIs for establishing connections and sending data over different types of connections, the most popular being Winsock, the API for Internet gaming. While Winsock forces game developers to code specifically to support each network protocol, DirectPlay can mix and match protocols. DirectPlay is designed to make it extremely easy for gamers to find other players and get connected without having to worry about the details of protocol and connection type. DirectPlay can connect across several different network types concurrently, allowing modem jockeys to deathmatch on a LAN.

DirectX 7.0 is likely to include hardware acceleration of transformation and lighting, as well as geometry morphing.

Embedded into DirectPlay is the idea of a game lobby, a specialized user interface for players to use in finding other players. Once a game is "marshaled," DirectPlay can connect you to a different network to play the game. So once you find someone to play *Quake* on the Internet, for example, DirectPlay could initiate the game using local Dwango servers for reduced latency.

Anytime DirectPlay gains support for a new network service provider such as AOL, all DirectPlay games also get support for that service. DirectPlay games don't have to be upgraded to support Winsock 2.0, multicasting, or firewalls. They get it for free with DirectX 6.0.

DIRECTX 7.0

Still in the planning stages, DirectX 7.0 is likely to include another huge leap forward in 3D. Major new enhancements include cuts to Direct3D overhead and programming enhancements to make Direct3D more straightforward for developers. Support for hardware acceleration of transformation and lighting is planned, as well as geometry morphing, which allows 3D models to be dynamically transformed from one mesh into another. There's also some tentative talk of releasing some early Fahrenheit technology in DirectX 7.0, namely SGI's large-scale scene-graph-management system.

By popular demand from hardware manufacturers, Direct3D may acquire an extension mechanism to make it easier to implement broken drivers with less customer accountability. Microsoft says it will create a mechanism for registering extensions, which should make it easier to identify the guilty party when problems crop up. Extensibility allows hardware manufacturers to build drivers that aren't tested for stability by Microsoft's WHQL labs. Every driver architecture Microsoft has ever made extensible has resulted in a support nightmare, so this may be a great example of being careful about what you wish for.

An exciting addition planned for DirectDraw is support for stereo vision, once called DirectVR, and support for light guns. Alpha blitting will be added also, so that 2D applications can take advantage of 3D accelerators if they're present.

DirectInput will get a force-feedback authoring tool, a semantic mapper for arcane input devices, and light-gun support. Coin-drop devices will also be supported as part of Microsoft's arcade initiative.

DirectSound will acquire more sophisticated voice-management support, allowing for priority playback and scalable 3D positional audio from high-quality hardware acceleration to low-cost stereo positioning. It will be possible to place loop points at arbitrary locations in the audio stream, add environmental reverberation, and apply filters on a per-voice basis.

Other plans for DirectX 7.0 include a desperately needed profiling API for realtime applications to measure system performance. Visual Basic and Java support will be added to DirectX, probably adapted from Chrome, and the core redistributable files will be shipped in a compressed format to reduce download time and space consumption on CDs.

DirectX 7.0 is scheduled for release in the second quarter of 1999. No mention has been made of Y2K compliance however, which may mean that DirectX 7.0 games will all fail with mysterious driver problems shortly after Christmas.

DIRECTX 8.0

The only publicly discussed feature of DirectX 8.0 is the much-rumored Fahrenheit 3D technology, born of a joint effort between Microsoft, SGI, HP, and Intel. Fahrenheit will include a dramatically overhauled low-level 3D API that's backward compatible with Direct3D (not OpenGL, although it will most likely support all OpenGL functionality). A new high-level 3D API for managing complex 3D scenes will also be released for Windows, Irix, and HP-UX. This API will support all the technologies used by cutting-edge games, such as cell portal visibility, BSP trees, and collision detection. Character skinning and audio extensions are also anticipated in DirectX 8.0.

The Evolution of DirectX

DirectX, originally known as "The Manhattan Project" at Microsoft, started as a Skunk Works project by three Microsoft evangelists during the crunch to release Windows 95. At the time, Microsoft was in heavy competition with Apple for dominance in multimedia technology. For years, Microsoft failed to get an edge on Apple in graphics and video playback, and almost all multimedia used Apple's QuickTime technology, which annoyed Bill Gates immensely. Despite having dozens of developers and evangelists, Microsoft couldn't wrest control of multimedia from Apple. At the same time, thousands of DOS game developers were creating wildly popular multimedia content on the PC that didn't rely on Apple technology. The solution was to get Windows to support DOS content better than DOS, and saturate the Windows platform with nonvideo based multimedia titles.

id Software played a crucial role in the evolution of DirectX, since the popularity of *Doom* made the powers that be at Microsoft pose the question, "Why can't this be done in Windows?" id provided Microsoft with the source code to Doom, and a developer from the advanced research group vainly attempted to port it to Windows 3.1. After a few months, he died under mysterious circumstances (really!). The *Doom* port became the crucial test to verify that the Microsoft Game SDK (later DirectX 1.0) was doing its job.

DirectX 1.0 drew together several disparate technologies, which weren't completely unified until subsequent DirectX releases. DirectInput and CD autoplay (which wasn't officially a DirectX technology, but was essential for easier game installation) were squeezed into Windows 95 at the last minute. A technology created by Intel called DCI evolved into DirectDraw. DirectSound was written for Microsoft by game-industry audio guru John Miles, and DirectPlay was stitched together by an English contractor who, after months of intense coding, nearly had to be carried out of Microsoft on a stretcher.

The rightful title of DirectX architect goes to an ex-Technical Evangelist named Craig Eisler, who is now General Manager of Microsoft's streaming-video technology. Eric Engstrom, currently the General Manager of Chromeffects, managed the DirectX project. Eric originated the atomic theme for DirectX when it was still a Skunk Works project. Look for an interview with Eric in November issue of *Maximum PC*.

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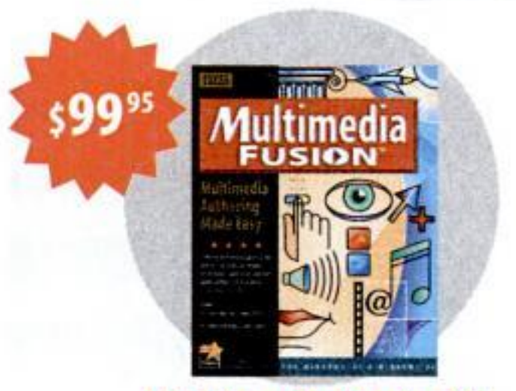

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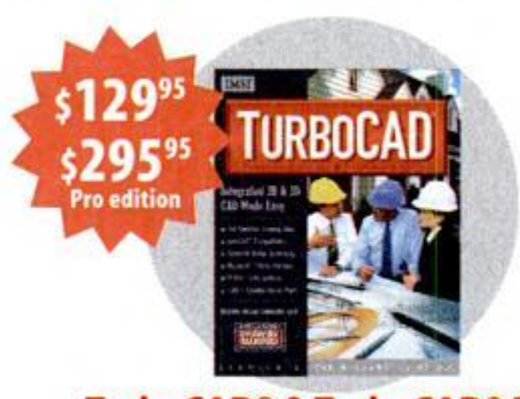

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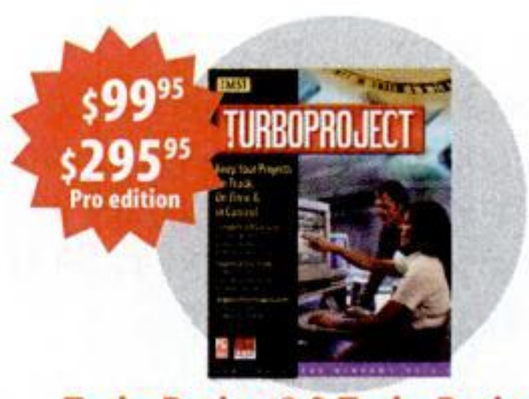

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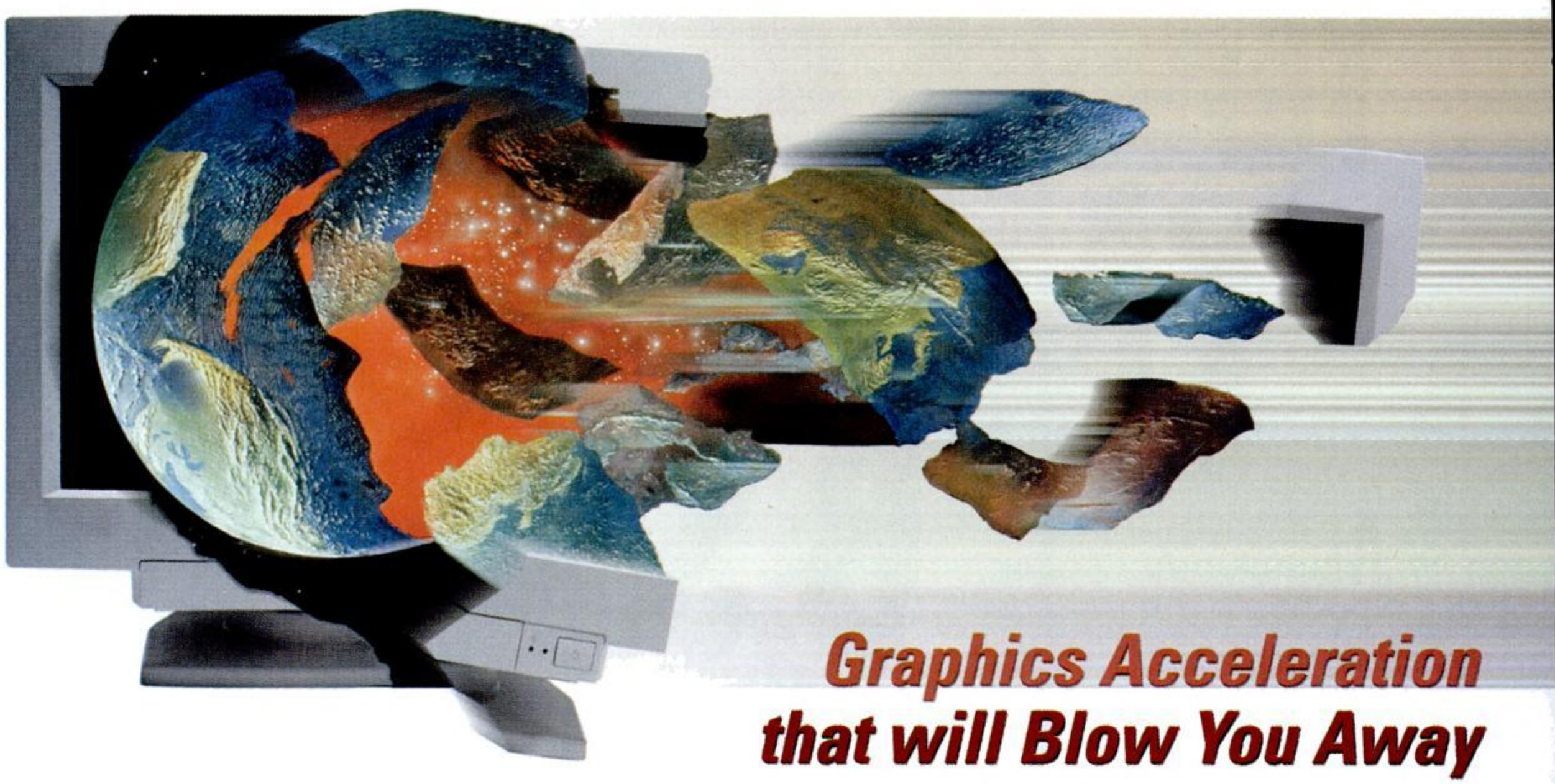

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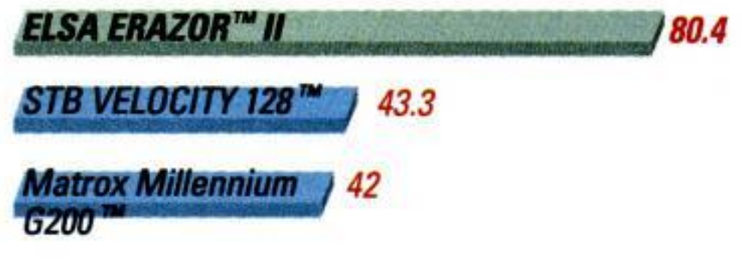

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Unreal Lag

I'm having a problem playing *Unreal* online. When I depress the fire button there's a delay. It's the same type of delay one gets with a cheap graphics card. I've tried different resolutions and different servers but can't seem to get fluid responses.

When I use online services at night, I don't have this problem, but when I play during the day, I do. This leads me believe that it's just heavy traffic on the servers. Is this right, or could there be something I'm not doing? Most of the time no more than three people are playing in any given game, sometimes as many as 10, and even just me in the game room alone—yet the problem persists.

—Joseph Christopher Carbone III

The Doctor hates lag and it sounds like you've got it. Your observation of the time of day when this occurs lends credence to this argument. But, *Unreal* also has some major multiplayer issues it needs to sort out, so I would also recommend downloading the latest patch for *Unreal*. Go to **www.unreal.com** to download the patch.

Buckets Of Stealth Problems

In Windows 95, my dad's Stealth 3D 4000 video-card is not recognized as an AGP-compliant board. With Diamond multimedia drivers, *Final Reality* refused to run AGP code and crashed. Using S3's drivers, I could at least run the benchmark, but at the pace of a PCI-based card. Would Windows 98 fix our problems, or is the Stealth 3D 4000 just a really poor design that is beyond hope?

We are thinking about buying the ATI All-In-Wonder Pro (AGP 2x with the Rage Pro chipset) to replace it. Do you know if ATI is planning a newer part within the next two quarters? Does any other company offer a good "all-in-one" solution?

—William Bickford

The Doctor The technology the Stealth 3D 4000 is based on is S3's ViRGE/GX-2 architecture, which is an AGP 1x DMA part. This means the ViRGE/GX-2 cannot access your system memory for texture storage and execution. In effect, it's acting like a PCI card, and if you attempt to force textures down its throat, it will choke and run at 1fps. This is a limitation of the hardware architecture, and installing Windows 98 will not help.

With regard to ATI, like all 3D accelerator chip makers, it is always working on next-generation technology, and it should have the successor to its Rage Pro chipset ready by early 1999. The exact specifications of this chip are still under wraps, so the Doctor can only speculate ATI will attempt (like everyone else) to get single Voodoo^2 performance in a 2D/3D solution. Unfortunately, not too many other companies work that "all-in-one" magic like ATI does, so if you are looking for a TV-tuner/TV-in/out/2D/3D combo, you may have to stick with ATI. The only other feasible option would be Matrox, which offers bolt-on, add-in functions for its Millennium/Mystique G200 series of boards.

Dot-Pitch Gripe

Since I've upgraded my computer, I've been in the mood for a new monitor. I'd like a 17-inch with a 0.25mm dot pitch, but the price of a good one is too high, so my friend and I were debating whether the difference in dot pitch is worth the extra money. He thinks I should get a cheaper 0.28mm dot pitch, since the difference shouldn't be that much. I say the quality will be a lot better on a 0.25mm dot pitch and I think it is worth the extra cash. Could you tell me which one of us is right?

—Disco Bubba

The Doctor doesn't mean to be flippant, but a 0.25mm dot pitch is exactly 0.03mm finer than a 0.28mm dot pitch. The Doctor's old peepers can discern a difference, but the Doc's eyes are trained to recognize such subtleties. Given the low prices in today's 17-inch market, a thorough search should net a 0.25mm dot pitch for the right price. And please keep in mind that dot pitch is just one factor that determines display quality. The Doctor recommends that you simply buy the best-looking monitor for the money, and not worry about arbitrary specs.

Screwed Up Modem Speeds?

I my friend jacked up the speed of his internal modem with a screwdriver. How can I do the same?

—Nick Hemp

The Doctor Short of using the screwdriver to jack a gas station and then buying ISDN or xDSL with the ill-gotten booty, the Doctor can't think of this working.

If someone has an idea of how this works, the Doctor would sure like to know. Current consumer-grade technology tops out at about 54K downstream under optimal conditions and 33.6K upstream, unless you use a multilink protocol or Diamond's Shotgun bonded modem.

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No Ground, No Sound

My CD-ROM drive won't work with music CDs. It'll play data CD-ROMs fine, but songs from the CD won't play through the speakers, only through the headphone jack on the front of the drive.

I've been poking at the registry and all the config files, but nothing is working. I don't want to reinstall Windows 95 either. I have an ESS-1869 AudioDrive soundcard. I don't think the soundcard is having problems. I think it's something with Windows and the config files.

—Kun Lee

The Doctor You didn't mention if it plays WAV or sound files, so I assume it does. You can try double-clicking the speaker icon that should be in your system tray. That'll bring up a mixer for the sound devices on your PC. It should default to playback. If it doesn't, click on Options, Properties, and the circle box for Playback, and make sure it shows a check mark in front of the CD box. Click OK and make sure the volume control or master volume is cranked up and the Mute All box isn't checked. Do the same for CD. If it's still not working, it may be a hardware problem. Have you upgraded hardware lately? You may have knocked the CD sound cable loose. Check the cable that runs from the back of the CD-ROM to the soundcard and the connections from the soundcard to your speakers. Also make sure you have the correct type of audio connector cable and that it is inserted in the correct direction. You may have to pull the drive out to check the proper orientation of the connector.

More RAM, Slower Speeds

I have an older 66MHz 486 computer and just upgraded my RAM. I had two 8MB 72-pin modules, now I have four 4MB 30-pin modules and two 16MB 72-pin, totaling 48MB. I fired it up expecting better performance, but it instead runs slower!

—Dalan Galma

The Doctor Your slowdown may come from various areas. Many older 486 motherboards that took multiple memory module types had Byzantine memory configurations. First check your motherboard manual. It should have a table of supported memory configurations. You can't just snap in any memory module. Assuming the machine booted and recognized all 48MB of RAM, your next step is to play with your memory timing in your BIOS settings. Consult your motherboard manual or experiment after writing down your original settings. Also try booting the system with the two 16MB SIMMs. Since they're newer, they're probably faster, and you may see the best performance running just the two 16MB SIMMs.

DIMMs The Info

I've recently gone hog wild and done the upgrade thing. How can I tell if the RAM I've purchased is the 100MHz variety I was supposed to get? I don't think the company I purchased my system from ripped me off, I'm just curious if there's some way of telling the speed of the RAM (other than ripping the case apart). Thanks for any wisdom you can share with me.

—John Houston

The Doctor Download this nifty DIMM ID program from Vanguard Microelectronics Ltd. in the UK (**www.vml.co.uk**). It'll query the SPD on your DIMM for bank number, manufacturer, part number, serial number, size, type, and spec type. If there's no SPD, you've been had. All PC100-spec RAM should have an SPD that tells the motherboard what to set the speed for. This is no guarantee, however. Some crooks can simply reprogram the SPD to contain any information they choose, as well as remark the exterior. Your best protection in the rough-and-tumble RAM market is to buy from a reputable dealer.

Stuttering Crashes

I'm finally getting into the Voodoo² scene, but I'm unsure about the installation and patches and drivers and stuff.

I bought the Helios 3D Voodoo² with 12MB of RAM for my 200MHz MMX Pentium. *Quake II* will run, but the sound is choppy and it locks up after a minute or two of play. Could this be happening because of overheating or old drivers? I visited the manufacturer's web site, but didn't find any new drivers. The system is not overclocked.

—Peter Hryniewiecki

The Doctor recommends that you check the manufacturer's site again. At press time, it showed a Voodoo² product, but no apparent driver updates.

Does it lock up in normal play or multiplayer? If it's multiplayer, that could be an entirely different networking issue. Visit Microsoft's web site at **www.microsoft.com/windows/getisdn/dload.htm** to download the latest Dial-Up Networking 1.2b and Winsock upgrade for Windows 95. Also, hit the *Quake II* X2 workshop at **www.navpoint.com/~zephed/qx2.html** for further help.

Overclocker's Corner

If you have that ultimate need for speed, overclocking your system is a cheap boost. Be advised, however, that overclocking voids your warranty, so you'll get no more support from the manufacturer of the part in question. And overclocking anything will greatly increase the operating temperature of the part. This not only may result in intermittent lock-ups or visual glitches, but could destroy the processor outright. You've been forewarned.

Overclocking Doldrums

I just tried overclocking my CPU and ended up empty handed. I have a 5SVA TomatoBoard (VIA Apollo VPX mainboard) with an Intel 200MHz Pentium MMX and the latest BIOS update.

What did I do wrong? My 66MHz motherboard supports 233MHz for the CPU (3.5x). I set the jumper for that speed but the CPU wouldn't take more than 200MHz. The other ratio frequencies work fine, but 200MHz is the limit. Is this particular Intel chip limited to 233MHz, and does my TomatoBoard support the K6-2 with 3DNow!?

—Victor Guevara Masís

The Doctor believes you've encountered Intel's nasty protection against overclocking. Unless the motherboard supports other system-bus speeds, such as 75MHz, you may not be able to squeeze the extra juice out of your CPU. Unfortunately, your motherboard does not support the new AMD K6-2 CPU. You'll need an AMD-approved core-logic chipset, such as VIA's MVP3, ALi's Aladdin V, and others.

I Can't Drive 448MHz

I recently took the plunge and upgraded to an RDI 400MHz Pentium II system. It uses a Soyo motherboard with an Award BIOS. The bus clock can be incrementally varied from 66MHz to 112MHz (66, 68, 75, 83, 100, 103, and 112). The system has three variable-speed fans for SYS, CHS, and CPU (the fan speeds are also displayed). The multiplier can be incrementally varied from two to five. Changing the multiplier higher than four does not work, and the CPU defaults to 200MHz. Varying the clock does work, and at 112MHz x 4, the CPU runs at 448MHz. The CPU has a warning temperature set at

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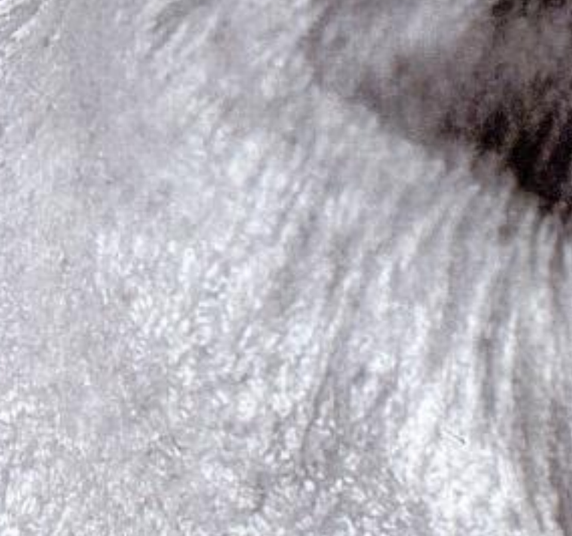

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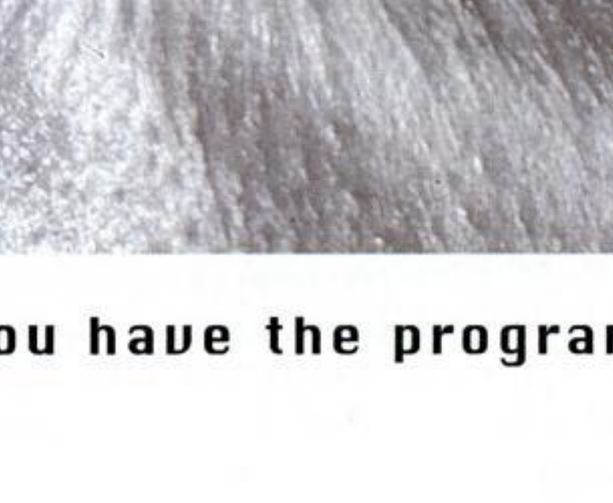

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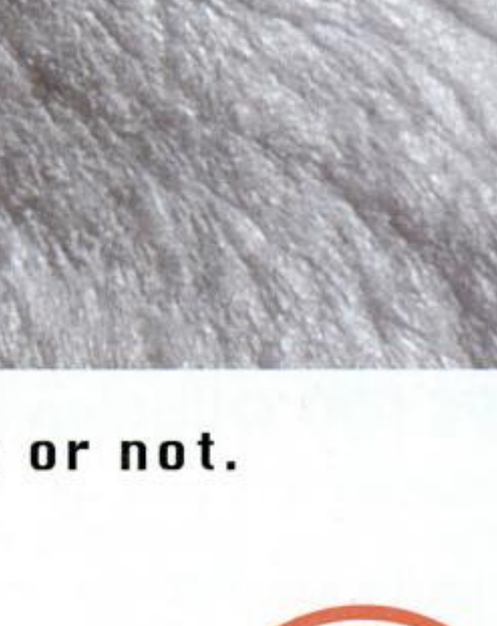

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Another strong possibility is bus hogging from your Voodoo². Some videocard drivers snatch control of the bus for incredible lengths of time, causing stuttering sounds. Try adding this line to your AUTOEXEC.BAT file by right-clicking on it and choosing edit.

SET SSTV2_FASTPCIRD=0

After making the changes, reboot and give it a whirl. You might also want to try reducing the acceleration slider for your videocard and setting *Quake II*'s sound to max compatible.

DirectError

My friend supposedly gave me a copy of the final version of DirectX 6, but when I tried to play *Final Fantasy VII*, I received a message saying that DirectDraw Beta needed an update. I tried everything to fix this problem, but nothing has worked. I want to know if there is any way to uninstall DirectX 6 without formatting my hard drive.

—Jimmy Chen

The Doctor thinks you don't actually have the final release of DirectX 6. You probably have a Release Candidate with an expiration date. Try downloading the latest version of DirectX 6 at **www.microsoft.com/directx/resources/dx6end.htm** or grabbing it off the Maximum CD. You should theoretically be able to back down to DirectX 5.2 by uninstalling DirectX in Settings/ Control Panel/Add & Remove Programs.

PC100 Dilemma

I have read all about the 440BX chipset motherboards, but I can't set one thing right. The Intel Pentium II 350MHz+ processors require PC100 SDRAM. But can you install PC100 SDRAM on a 440BX motherboard with a 333MHz Pentium II processor, rather than installing with PC66 SDRAM?

—Adam Smith

The Doctor has a neighbor named Kenny whose middle name is "El Cheapo." El Cheapo bought a BX-based motherboard earlier this year and 128MB of PC100 spec RAM, and clicked in a 266MHz Pentium II. Kenny reports all is fine, and he is happily waiting for 400MHz prices to drop lower than a snake's belly before upgrading and taking full advantage of the 100MHz bus.

NHL Takes Out My PC?

During gameplay or playing music, my computer just powers down. The monitor and PC are on the same outlet, but the monitor stays on. I also noticed that it sometimes dies during boot up or two minutes into Windows 95 while I'm running *NHL 98*. I reformatted the drive and reloaded Windows on the advice of a friend who thought it may be a driver conflict. The problem continued. Then I noticed the *NHL 98* CD was dirty, so I cleaned it. The crashing has since subsided and seems to occur only when a dirty or scratched CD is in the machine.

Does Windows 95 or my CD-ROM drive know to shut down the system when it tries to read a dirty or scratched CD? Is the operating system that smart? I don't think it's a virus because I've scanned the machine with McAfee anti-virus software.

Or could this problem be my power supply or the mixed RAM I'm using? It's a homebuilt 166MHz Pentium MMX with 64MB of RAM in an AT case. I have both fast page and EDO RAM on the motherboard.

—Nguyen Hong Mai

The Doctor thinks those hockey players are tough hombres, but its doubtful they're shutting down your machine. Is the computer really powering down? It may be possible your computer errors out on the dirty CD during gameplay and just crashes. Instead of giving you an error message, it may simply lock the machine with a black screen and look like it shut down. If your machine is really powering down, the drive will spin down, the fans will stop whirring, and of course the LEDs in front will wink out. While the Doctor has seen odd software glitches shut down an ATX machine that allows the operating system to turn off the power supply, older AT machines cannot normally do this. You may want to set the power management in the BIOS to off, as well.

You want to run with one type of RAM in your machine, and if your system handles EDO you should go that route. Try running with just the EDO RAM and reseating the SIMMs. If that doesn't isolate the problem, try reseating cards one at a time to see if the problem goes away, or swapping with cards you know work. Also try switching your power cable, which may have been crimped, and also plug it into a different wall outlet. There may also be a momentary short circuit in the box. Look for loose or dangling metal objects or cables and tuck those away. You may also consider swapping power supplies. Make sure you buy a power supply for your AT case with a prewired switch. It's a confusing mess to wire it yourself. Finally, the worst-case scenario is that your motherboard may be bad. ✹

Overclocker's Corner

50°C, at which point I believe the CPU fan, which normally does not run, will turn on. At 112MHz, the CPU temperature increases from about 38°C to 46°C after a few hours. Everything is stable; everything works!

I would like to go for the magic 500MHz. Do you know of a way I can increase the clock speed to 125MHz?

—Vernon D. Shepherd

The Doctor must sadly inform you that you're reaching the current limit the 100MHz front-side bus Pentium II CPUs will do. You may want to download the latest BIOS from Soyo, which allows up to a 133MHz system-bus setting. Go to **www.soyo.com.tw** to grab it.

Getting Paid

I'm looking to put together a new 3D-gaming system. I found this base system in my price range: AMD K6-2 300MHz with 3DNow! technology, on a PC WAVE M577 (AGP) 100MHz BUS motherboard, with AGP support and the TX-PRO chipset. It has three PCI, two ISA, and one AGP slot, supports almost all the Socket 7 flavors, and has Sound Blaster compatible onboard that can be disabled.

It says that it accepts speeds of 90MHz to 350MHz. Could I overclock to 350MHz? Also, are there any flaws with this motherboard?

—Scott Lerch

The Doctor thinks overclocking to 350MHz should be easy. Just set the jumpers for the 100MHz bus and 3.5 multiplier. The motherboard itself, however, does beg a few questions. First, it only supports the first version of AGP (AGP 1x), and by now all self-respecting AGP cards are up to version 2. Second, the motherboard's PCI slot situation doesn't bode well for upgrading. Install two Voodoo² cards and a PCI soundcard, and you've hit your expansion ceiling. Third, that TX-PRO core-logic chipset (manufactured by ALi) is a knock-off of Intel's 430TX chipset, and The Doctor has heard negative anecdotal reports on its performance and reliability. The bottom line: If The Doctor were going to buy a K6-2-based system, he'd go for a motherboard that boasts the ALi Aladdin V, the same core-logic chipset AMD used in its original K6-2 reference machine. ✹

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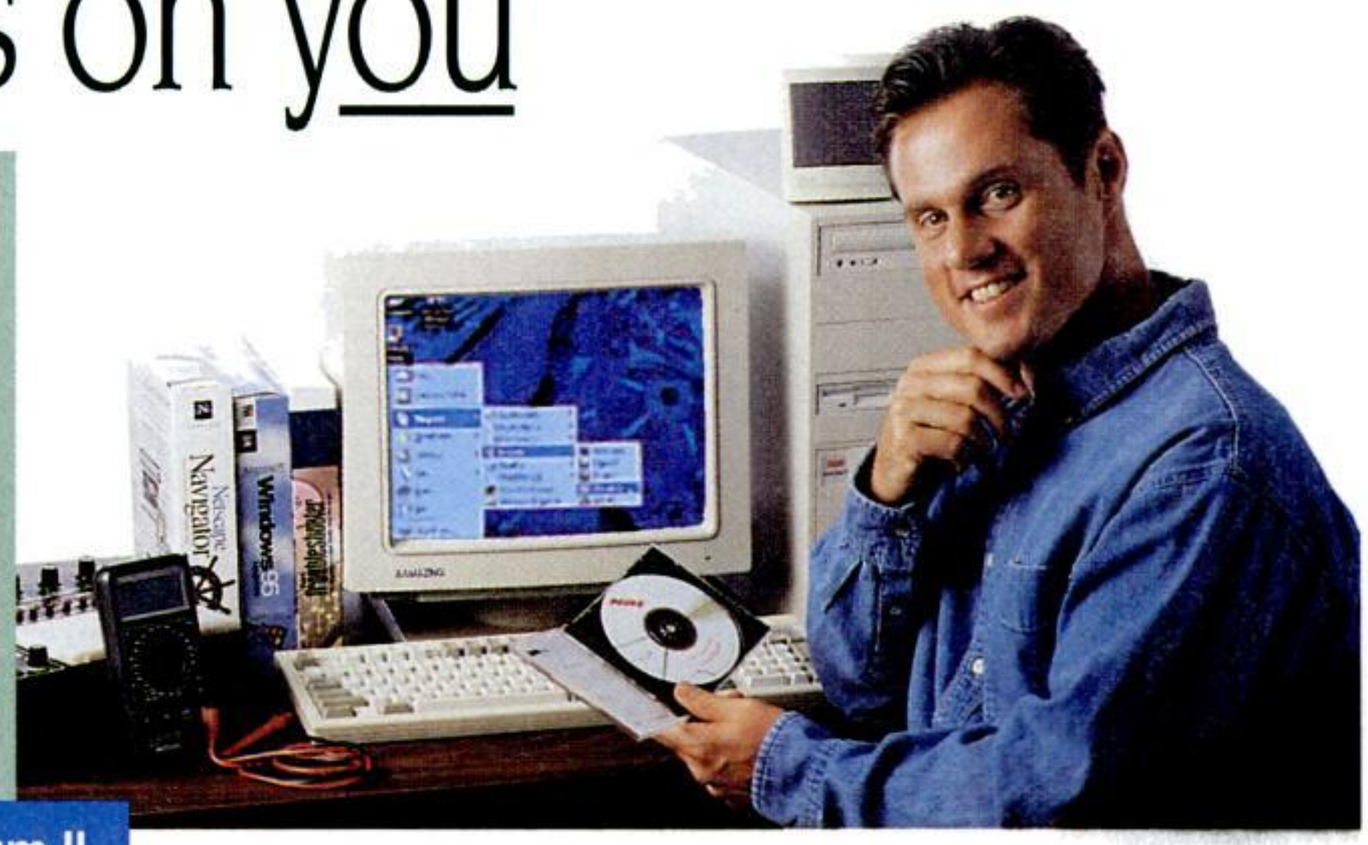

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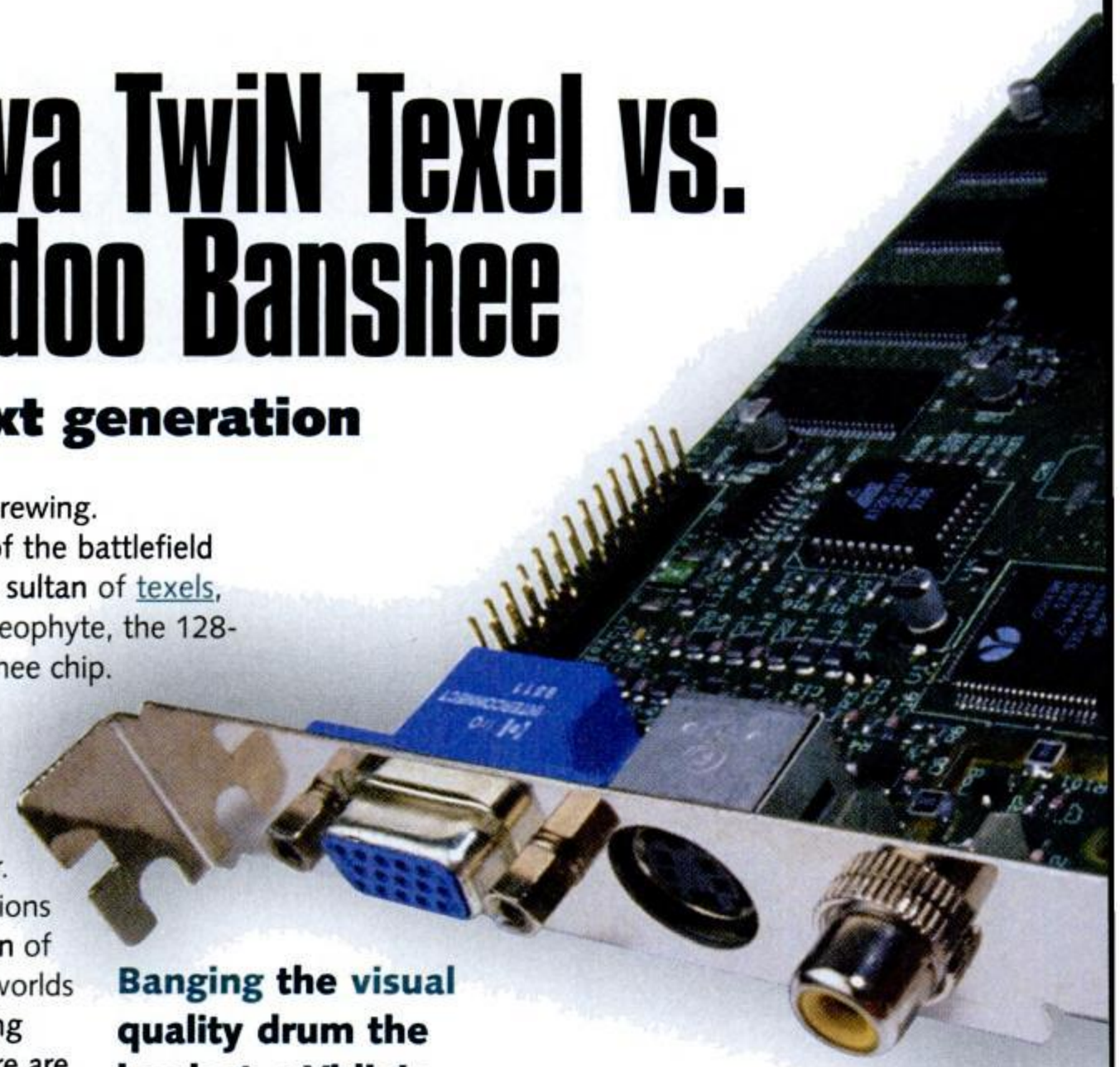
nVidia Riva TwiN Texel vs. 3Dfx Voodoo Banshee

2D/3D: The next generation



Banging the visual quality drum the loudest, nVidia's TNT is poised to once again break benchmarks and take names. STB's Velocity 4400 (shown here) will be among the first TNT-armed boards to be released.

hands on MAXIMUM PC exclusive

A digital jihad is brewing.

On one side of the battlefield stands 3Dfx, the sultan of texels, with its 2D/3D neophyte, the 128-bit Voodoo Banshee chip.

Eyeing 3Dfx balefully from across the field is nVidia, with its TwiN Texel (TNT), whose 2D/3D Riva 128 chip helped propel it back into this holy war.

Both sides have fanatical legions eager to see the next generation of 3D accelerators whip polygon worlds into 60fps+ frenzy. Awe-inspiring visual quality and features galore are the salvation these chipsets preach.

It's time to choose sides.

BANSHEE HOWLS

Multitexturing—the ability to apply more than one texture on a polygon in order to simulate visual effects—is the 3D-gaming feature-du-jour. Games such as *Quake II* use multitexturing for lighting, and any games based on *GLQuake* technology will take advantage of multitexturing if the videocard supports it. Even Microsoft's DirectX 6 will work multitexturing magic. But more textures require greater processing power, which requires a physically larger 3D processor.

3Dfx takes the brute-force method by populating Voodoo² boards with three video processors—two of them (the texelfx2 chip) dedicated for texture storage and processing. With these dual texelfx2 chips in tow, Voodoo2 is currently the only 3D accelerator capable of rendering multiple textures in a single-rendering cycle (or pass). Other videocards will either not do multitexturing at all (such as i740, Riva 128, and Permedia 2). Those that do so take a performance hit due to the repeated rendering cycles (such as Matrox's MGA-G200 and S3's Savage3D).

The Voodoo Banshee, unlike the older Voodoo Rush architecture (a bolt-on combo with Alliance Semiconductor's 2D part), is a 2D/3D engine engineered in-house from scratch by 3Dfx.

The Voodoo² heart inside Banshee translates

Riva TNT*

BENCHMARKING / FIRST LOOK		
FORSAKEN 800x600 fps	106.9	
FORSAKEN 1024x768 fps	69.6	
BATTLEZONE 800x600 fps	47.8	
BATTLEZONE 1024x768 fps	45.9	
QUAKE II 800x600 fps	56.8	
QUAKE II 1024x768 fps	39.7	

Voodoo Banshee**

BENCHMARKING / FIRST LOOK		
FORSAKEN 800x600 fps	98.6	
FORSAKEN 1024x768 fps	56.1	
BATTLEZONE 800x600 fps	—	failed to run***
BATTLEZONE 1024x768 fps	—	failed to run***
QUAKE II 800x600 fps	37.8	
QUAKE II 1024x768 fps	23.4	

* Results taken with an STB Velocity 4400 (16MB of SGRAM) beta silicon with beta drivers. ** Results taken with a Guillemot Phoenix beta silicon (3Dfx reference design) with 8MB of SDRAM and 3Dfx beta reference drivers. *** The application ran, but alpha-blending bugs rendered the frame counter unreadable. NOTE: All tests where conducted using the highest refresh rate the card would allow (100MHz or greater), with V-Sync enabled for both cards.

- nVidia Riva TwiN Texel 88
- 3Dfx Voodoo Banshee 88
- Tribes 93

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into Voodoo² performance for a single card in applications that do not require multipass rendering. Apps that use multitextures, such as *Quake II*'s lighting effects and bump mapping, will see a performance hit.

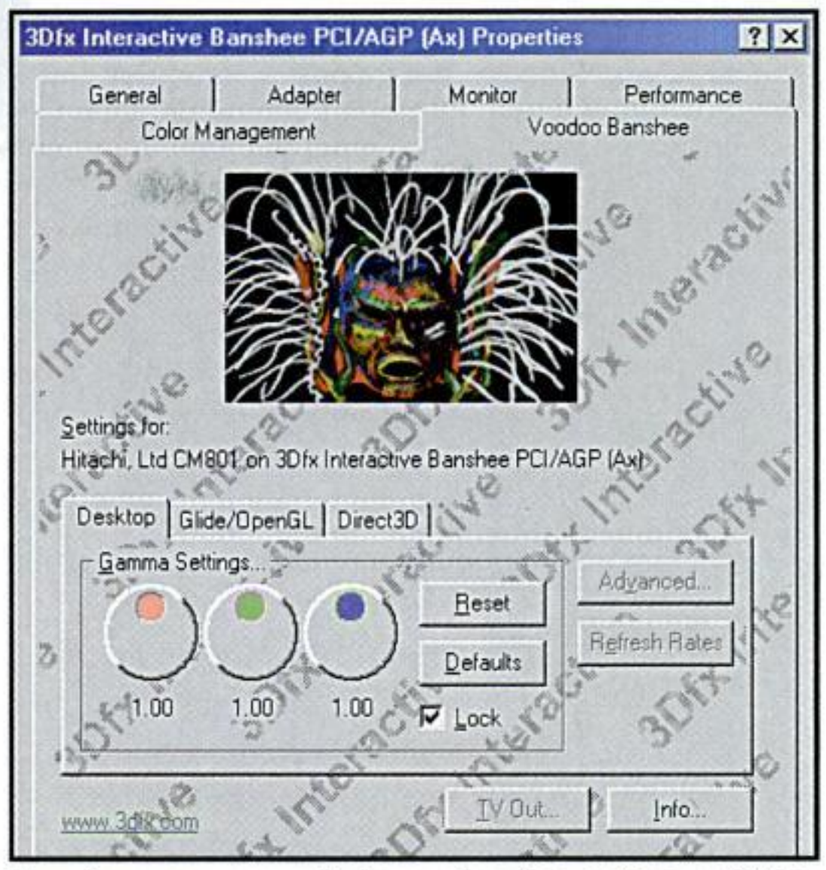
Unlike its heavier add-in card sire, Voodoo Banshee can run applications in a window.

Another dissimilarity between the two is in the memory architecture. Where Voodoo² was a split-memory bus—there was distinct, dedicated frame-buffer and separate texture memory—Voodoo Banshee uses a unified memory bus, which allows local memory to be divvied up between frame/Z-buffer and texture-storage duties. Up to 16MB of SGRAM or SDRAM via a 128-bit memory interface can call the Voodoo Banshee home. 3Dfx is hoping most vendors go with the 16MB scenario, as the current iteration of Voodoo Banshee is only an AGP 1x/DMA part, which means it cannot directly execute texture data transfer straight from memory, essentially turning it into a 66MHz PCI-esque device. Why? Blame the Voodoo², which was originally engineered for a PCI world. While this may not hurt Banshee initially, many OEMs see AGP 2x as a "must-have" item, and 3Dfx may find the road into high-end systems blocked. Regardless, 3Dfx hopes Banshee will make its mark in the sub-$1,000 arena.

While AGP direct memory execution is not a Banshee strength, the 128-bit core (in both Windows and DOS VGA) promises phat framerates to folks still pounding away at blit-busting DOS games. Most other videocards speed up 2D display through a combination of hardware and intense software optimizations (and cheats, such as bypassing the GDI in order to speed up 2D displays), but Banshee executes all Windows GDI calls in hardware. And with a 250MHz RAMDAC, you can bet the **refresh rates** flow.

Support for venerable 3D features such as per-pixel trilinear mip-mapping, full-scene, edge anti-aliasing, bump mapping, and palettized textures are also included.

As expected, the Banshee will have TV input and output.



From here, you can adjust your Banshee options until the cows come home. Moo!

TNT'S FUSE LIT

nVidia's TwiN Texel takes its name from the dual 32-bit graphic pipeline that renders multitextures in a single pass. Packing over 7 million transistors and built from the ground up, TNT is ready to take on all DirectX 6 has to offer, including:

- bump-mapping
- bilinear, trilinear (single cycle), and anisotropic filtering
- full-scene, order-independent anti-aliasing
- light maps
- environment and procedural mapping
- per-pixel perspective-correct fogging, lighting, and mip-mapping

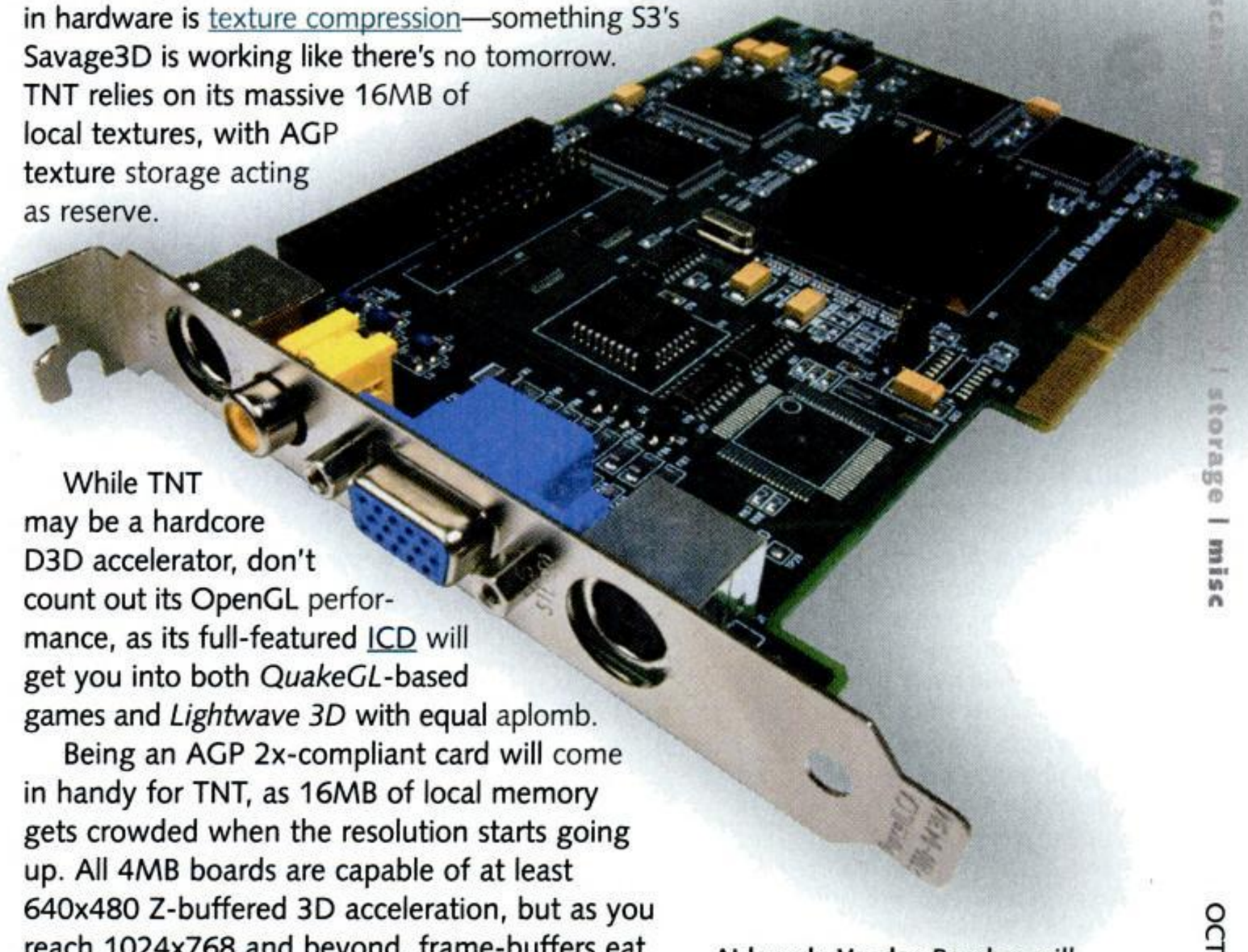
Thank features such as 12K of on-chip cache, support for 4MB to 16MB of local SDRAM/SGRAM, a 250MHz RAMDAC, and hardware triangle set-up engine, for all this goodness. An 8-bit stencil buffer can also be used for visual effects such as reflective surfaces. TNT's 128-bit accelerator handles Windows 2D, while DOS/VGA tasks are relegated to 32-bit processing.

The only DX6 feature not completely supported in hardware is texture compression—something S3's Savage3D is working like there's no tomorrow. TNT relies on its massive 16MB of local textures, with AGP texture storage acting as reserve.

While TNT may be a hardcore D3D accelerator, don't count out its OpenGL performance, as its full-featured ICD will get you into both *QuakeGL*-based games and *Lightwave 3D* with equal aplomb.

Being an AGP 2x-compliant card will come in handy for TNT, as 16MB of local memory gets crowded when the resolution starts going up. All 4MB boards are capable of at least 640x480 Z-buffered 3D acceleration, but as you reach 1024x768 and beyond, frame-buffers eat at local memory. Bumping up the color depth also eats away at local memory, and here's where the biggest difference between Banshee and TNT becomes apparent.

90 ▶



At launch, Voodoo Banshee will support only AGP 1x/DMA mode. Guillemot's Phoenix will follow 3Dfx's reference design almost to the letter, but will ship in a 16MB configuration (8MB version shown).

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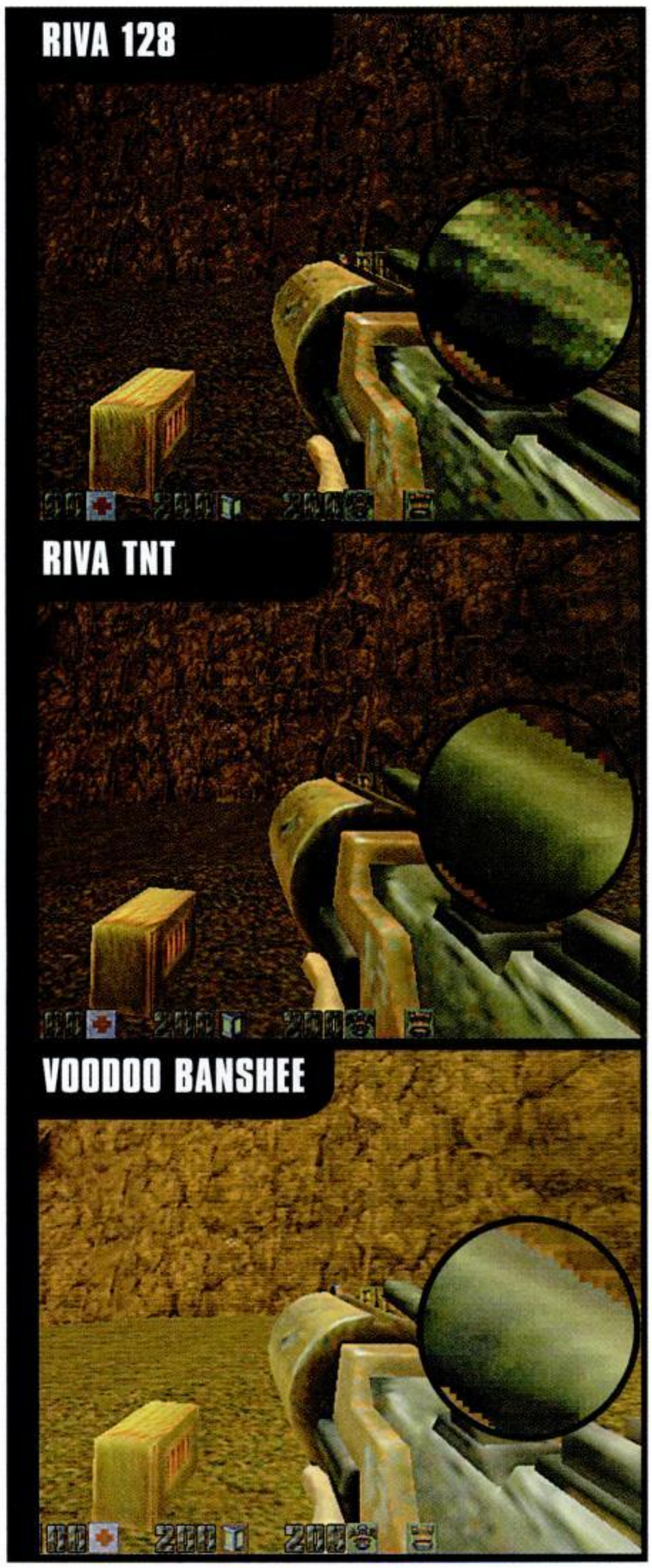

Quake II (under OpenGL) shows the dithered, pixelated rendering quality of nVidia's Riva 128 (top). The texture on the hyperblaster, in particular, looks very point-sampled when compared to other vendors' GL rendering. Note all those problems are gone in the Riva TNT (middle), which looks as sweet as (if not better than) 3Dfx's Voodoo Banshee (bottom). Big difference? TNT does OpenGL/DX6 multitexturing in a single pass—Banshee doesn't.

THE COLOR-DEPTH FACTOR

Just as the move from 8-bit (256) to 16-bit (64,000) colors in the last couple of years forever changed the gaming landscape, game developers are waxing eloquent about the virtues of even higher color-depth rendering. Moving to 24-bit (16 million colors) or 32-bits (16 million colors + 8-bit alpha) frees those digital wizards to create more vibrantly colored textures, resulting in photo-realistic gaming environments. But, a videocard must be able to render accurately at these higher palettes (more colors to display equals more work for the 3D accelerator), then be able to push the data onscreen at fast framerates.

TNT is ready to rock with 32-bits of internal rendering power. Output can go from a Z-buffered 16 bits, 24 bits, or 32 bits, depending on the app's requirements.

Voodoo Banshee, on the other hand, internally renders at 24-bit precision. But thanks to its Voodoo^2 heritage, Banshee dithers down the final visuals to a 16-bit Z-buffer accurate output. 3Dfx claims the Voodoo Banshee has 16-bit color "expansion" to display near 24-bit quality, but without applications to test this theory, how this will ultimately affect visual quality remains to be seen.

Anytime an image is dithered down to a lower color depth, data loss is inevitable and translates into banded or speckled textures, as the missing color data are filled with an approximation.

TAKING SIDES

Those same factions that used the popular Riva 128 chipset are once again marching to the nVidia drumbeat, including STB Velocity 4400, Diamond Viper V550, Elsa Erazor II, Hercules Dynamite TNT, and Creative Labs Graphics Blaster TNT.

Others, such as Canopus, have also announced plans on getting jiggy with TNT. Most of these boards will spec out almost identically, with 16MB being the sweet spot. Whether they go with faster SGRAM or cheaper SDRAM, as well as the TV output question, is yet to be determined.

3Dfx's OEM line-up mirrors nVidia's design wins. Expect those folks who got busy with Voodoo Rush to also slip into Banshee. Among the boards currently accounted for are Guillemot Phoenix, Creative Labs 3D Blaster Banshee, and Diamond Monster Fusion.

Intergraph, Elsa, and Miro are also getting bombastic with Banshee, although Hercules and Quantum3D are rumored to be in, as well.

CHARGE!

So how do these would-be 3D deities stack up? STB supplied us with a beta sampling of its Velocity 4400 16MB TNT board, while Guillemot's 8MB Phoenix answered the Banshee clarion call.

Under our 400MHz Pentium II test beds, and despite the beta nature of the boards, our first-look results show TNT outperforming the Banshee. From *Forsaken* to *Quake II* (normally a 3Dfx-optimized playground), the TNT's raw performance once again broke previous 2D/3D speed records. That whopping 106.88fps at 800x600 *Forsaken* was with beta silicon and drivers—no other 2D/3D board can flex this much pectoral without resorting to V-sync tricks, of course. Banshee was no slouch at 98.62fps under the same benchmark.

Quake II had the TNT's multitexturing beta OpenGL drivers tearing up the Banshee with authority. TNT crashed in with an incredible 56.8fps at 800x600 *Quake II*—compare that to the Banshee's 37.8fps. Playing the *SiN* demo on both cards also showcased the TNT's power. With 16-bit higher-res textures running under the *Quake II* engine, TNT had no problems playing at 800x600—Banshee stuttered under the same conditions.

On the visual-quality tip, TNT's rendering quality is rich and satisfying, with all the textures properly filtered and smoothed. While we did see the occasional texture seam, those should be fixed by the time final product rolls out. The only problem we saw was that games under GL were murky—again, driver optimizations and fixes should take care of this.

Like all great 3D battles, we can't tell who'll win until we see final silicon. And with the volatile nature of videocard drivers, optimizations will surely come on both sides of the fence, so expect even greater performance with final product.

—Andrew Sanchez

NVIDIA RIVA TNT AVAILABLE

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URL www.nvidia.com

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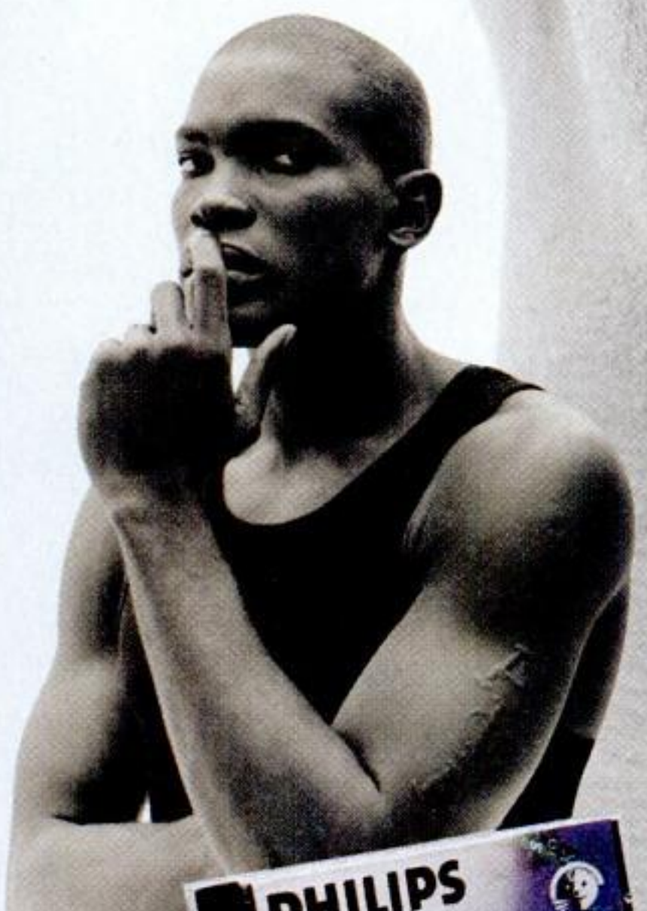

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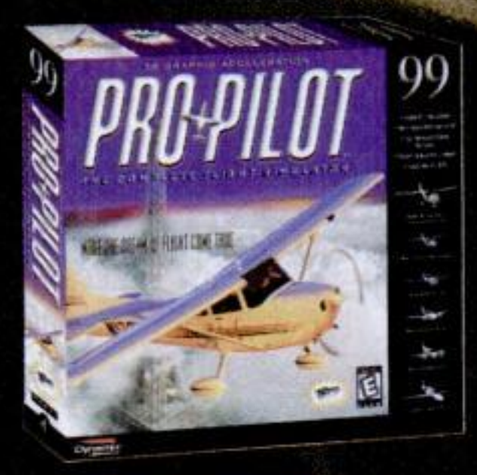

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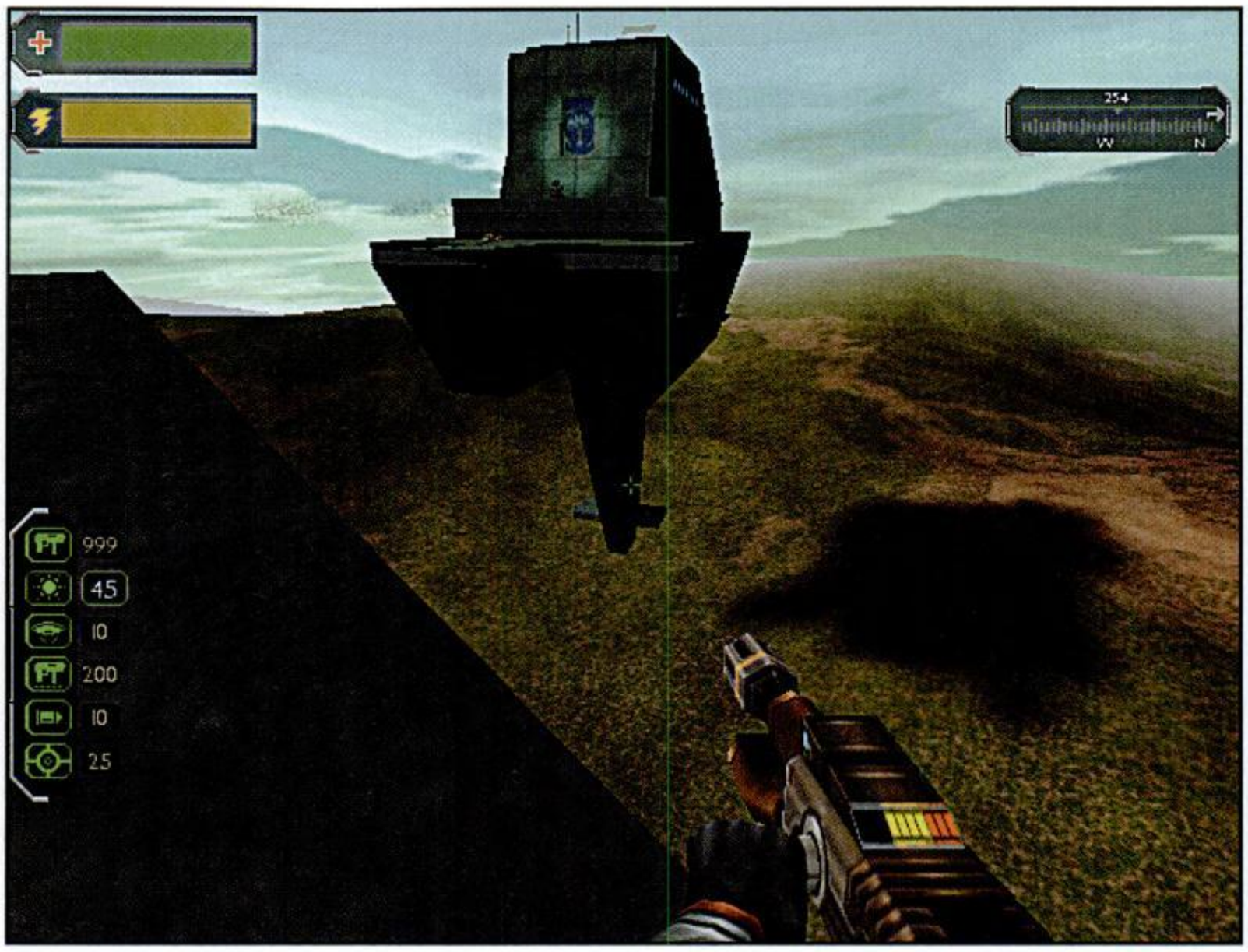
Tribes

It's a jungle out there

Tribes, the latest chapter of *Starsiege* from Dynamix, hasn't generated the kind of buzz typically associated with AAA titles such as *Sin*, *Half-Life*, and *Trespasser*. But after playing the alpha version of the game for three weeks, we agree that *Tribes* might just be the *Quake II* killer everyone's been waiting for. We spoke with game designer **Scott Youngblood** about *Tribes* and its multiple engines.



Maximum PC What's the game about?

Youngblood *Tribes* is a futuristic, first-person, multiplayer, squad-based tactical combat game that lets players team up and battle other teams (tribes). Players who work together will dominate those who do not. Four main tribes are included, but players can also spawn tribes from them.

MPC What is squad warfare?

Youngblood In *Tribes*, squad-vs.-squad missions are goal oriented. One example for a goal would be to move a convoy of vehicles from one location to another. One tribe will try to stop the convoy from reaching its final destination.

MPC What about gameplay?

Youngblood Players can move from first to third person on-the-fly, enter buildings, walk outside, and fly into the sky. Additionally, you'll be able to commandeer jet aircraft, take control of large weapons, and command your troops across a large terrain.

MPC What's the character polygon count?

Youngblood About 350, depending on armor type, at highest detail. As players are farther away from the camera, the poly counts are detailed down.

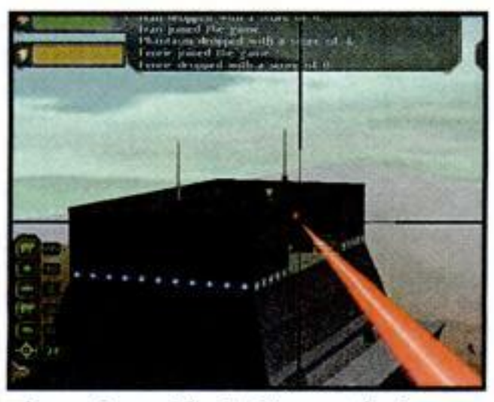
MPC What engines does the game use?

Youngblood The game uses three different engines: the interior engine for rendering building interiors and exterior polygons and lights; the terrain engine for rendering terrain polygons and textures; and the animating shape engine for player animations and destructible objects.

They were developed over the past two and a half years by Dynamix for the *Starsiege* games. They all work together without noticeable pauses. A player can run from the interior of a large floating building out an escape chute and fall hundreds of feet to the terrain without a single loading screen or gameplay pause.

In the Tribes' world, you can fly, run along the terrain, and storm into buildings.

You can run, but you can't hide when you have a colored tag over your head. The only way to get rid of it is to blow up the enemy's radar installation.



The sniper rifle is the perfect weapon for campers.

MPC What new multiplayer features are you offering?

Youngblood The Commander view will greatly enhance the ability for players to organize themselves and communicate. The display lets players form small groups (by choosing commanders) and send commands to one another. One squad might be designated as offensive while another would be the base defense squad. The goal of any level is to give users the freedom to organize however they choose for the current mission.

MPC How many players will be supported on the Tribes battlefield?

Youngblood There currently is no "hard coded" limit. The number of players a server can support will depend on the speed of the machine and its Internet connection. We're hoping to support large games (64+ players).

MPC Will you include a level editor?

Youngblood *Tribes* will ship with a WYSIWYG level editor for creating new missions or modifying existing missions.

MPC What APIs will you take advantage of?

Youngblood Native Glide (3Dfx chipsets) and OpenGL. We currently are not supporting Direct3D, but that may change following our undergoing DirectX 6 testing.

THE SPECS

REQUIREMENTS

Pentium 166MHz with hardware acceleration
Pentium 200MHz without hardware acceleration
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Testing Policy

Our product evaluation process is built on down-and-dirty, hands-on testing. All hardware benchmarking is conducted in the Maximum PC lab by Maximum PC editors, and, whenever possible, we use real-world applications to gauge performance. Our final verdicts are based on benchmark results and a subjective appraisal of product features.

Real-World Benchmarking

Our benchmarking charts are simple: The farther right the bar reaches, the better the hardware performed. Here's the deal on specific benchmarks.

►**CPU/MOTHERBOARD** Based on Symantec's System Information benchmark, the bootMark tests the CPU, its bus interface, memory, memory cache, and core-logic chipset. The final benchmark score is based on an arbitrary performance range.

►**WINDOWS APPS** BAPCO's SYSmark98 uses task scripts in popular productivity and content creation apps to test real-world performance. The benchmark also puts major stress on the videocard and driver, forcing it to draw complex screens in rapid succession. The final benchmark score is based on an arbitrary performance range.

►**HARD DRIVE** HD Tach measures multi-threaded hard drive performance. We publish the average 16k read score in megabytes per second.

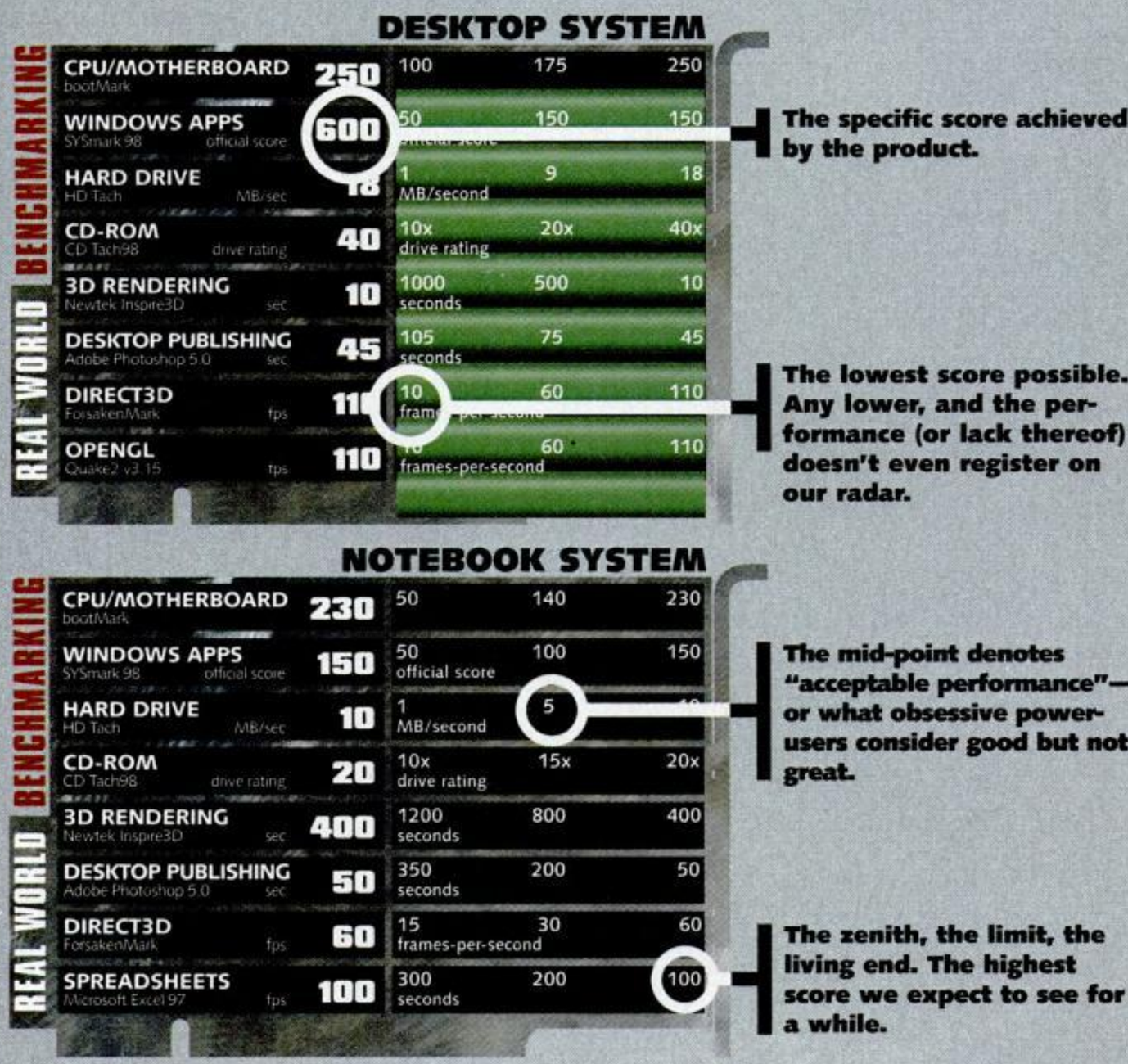
►**CD-ROM** CD Tach measures CD-ROM read times and CPU utilization. We publish the drive's cumulative speed rating (e.g., 24x).

►**3D RENDERING** We use Newtek *Inspire3D* to gauge how fast the machine can complete a complex ray-traced rendering—a grueling test of the CPU's floating-point power. Final score is in total seconds from start to finish.

►**DESKTOP PUBLISHING** In a scripted Adobe *Photoshop 5.0* test, we record how long it takes to apply various filters to a control image. A brutal test of the CPU, memory subsystem, and hard drive. Final score is in total seconds from start to finish.

►**DIRECT3D** *Forsaken* is a space shooter rich in colored lighting, and alpha-blending. Tests the 3D accelerator (and Direct3D drivers), and the CPU's floating-point. Final score is in average frames per second at 800x600. Also used in video card benchmarking.

►**SPREADSHEETS** A notebook-specific benchmark. Using Microsoft Excel, we have the app crunch through a fat spreadsheet, and we time how long it takes for the notebook in question. The faster, the better.



► **BENCHMARKING SYSTEM**

We use a Micron Millennia Xru with 400MHz Pentium II processor, 64MB of SDRAM, Intel 440BX motherboard, and Windows 98 with DirectX 6.0 core to benchmark all of our components.

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MAXIMUM CD

Over 20 Games, Utilities, & Demos on This Month's Disc

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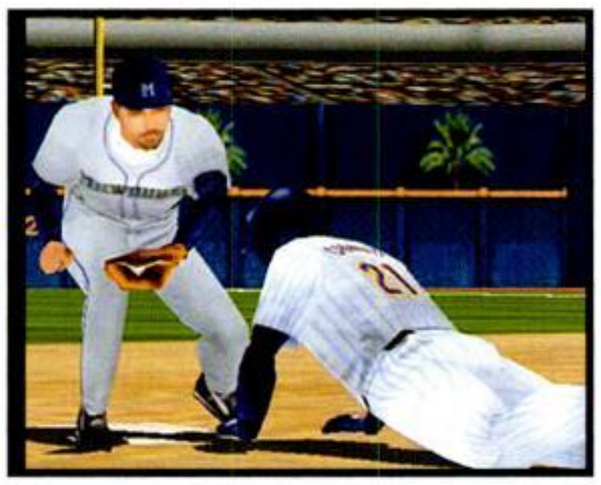

▶ **BASEBALL 3D**

▶ **FIREWORKS**

▶ **GOLDMINE 4.0**

▶ **MONTEZUMA'S RETURN**

▶ **MOTOCROSS MADNESS**

▶ **STRATA STUDIO PRO 2.5**

Every **MAXIMUM CD** comes with exclusive links to the **MAXIMUM PC** web site.

Perfect Your Picture

On this month's disc, we've included the demo version of *DisplayMate*, the definitive software for diagnosing and fixing all that ails your monitor. In the Maximum PC lab, we use DisplayMate's Video Obstacle Course test screens to evaluate traditional monitors and flat panels. These exacting screens are expressly designed to provoke a display's most subtle weaknesses—from geometric distortion, to inaccurate grayscaling, to annoying moiré pattern generation. Trust us: Your monitor settings need work. Launch the demo. Your tired eyes will thank us.

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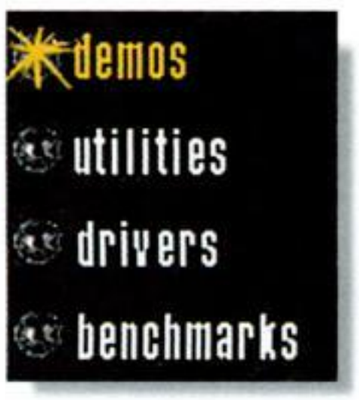
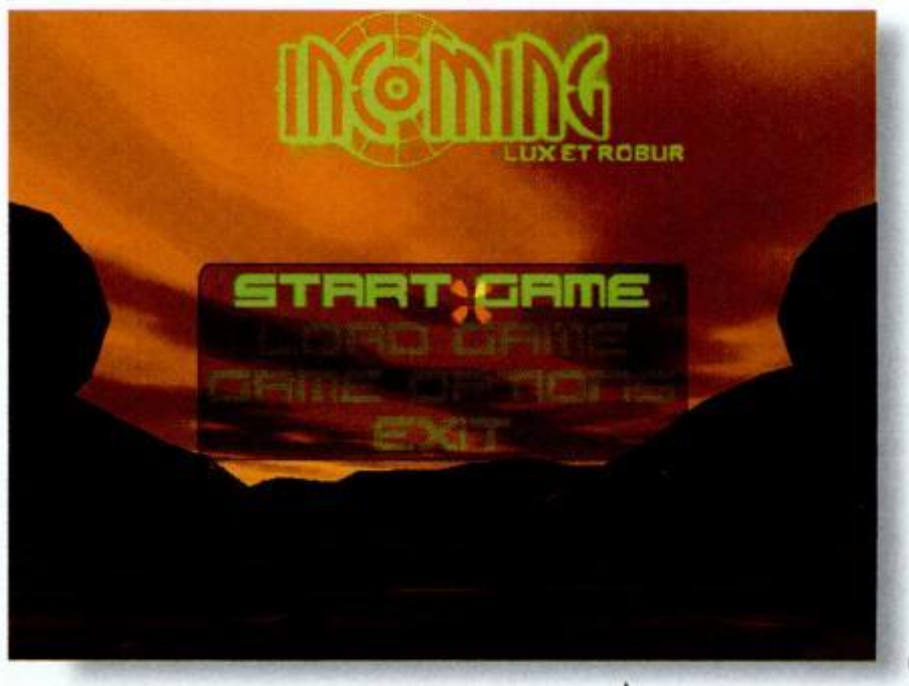
Clicking any of the interface screens launches a full-screen view of the program in action.

Clicking on the right side menu launches the publisher's web site for the program.

Use these buttons to navigate the disc and jump to each feature-packed section.



To install any of the software on the disc, click the "X" at the end of the app's description.



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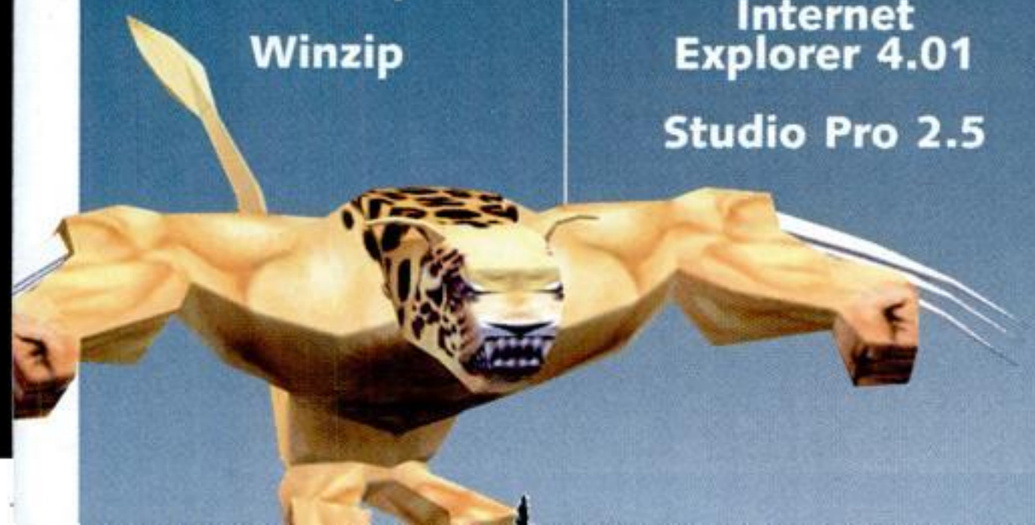
Winzip	Studio Pro 2.5	Urban Assalt
		War Games
		HardBall 6
		Triple Play 99
		Baseball 3D



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3D Card Benchmarking

▶ **OPENGL** *Quake II* is a first-person shooter rich in complex polygons and all those nifty OpenGL special effects. Tests the 3D accelerator (along with its OpenGL drivers) and the CPU's floating-point. Final score is in average frames per second at 800x600. Also used in video card benchmarking.

▶ **RAM SPEED** Stream for DOS 2.0 tests motherboard memory bandwidth in megabytes per second.

▶ **AGP PERFORMANCE** Final Reality AGP is a Direct3D benchmark that uses 20MBs worth of textures to tax the motherboard's AGP bus. Final score is in average frames per second.

▶ **BATTLEZONE** Another effects-intense Direct3D game. For videocard reviews, we run all three of our 3D gaming benchmarks at both 800x600 and 1024x768. Final scores are in average frames per second.

GUT SHOTS: FULL EXPOSURE, FULL DISCLOSURE
All system reviews feature large open case shots to give you a first-hand look at motherboard accessibility and expansion opportunities. And whenever possible, we show you the guts of individual components to illustrate what makes them tick.

EDITOR'S CHOICE AWARD:
Only 9 and 10 verdicts are even eligible for the coveted Kick Ass award, the mark of PC excellence.

MAXIMUM PC KICK ASS! Product

THE SPECS: A roundup of system requirements and bundled hardware and software.

THE SPECS
- BIOS
- WIN95 DRIVERS
- BUNDLE
- BUNDLE

PLUSES, MINUSES:
A quick summary for people who are too lazy to read the entire review.

PLUSES
Good Stuff

MINUSES
Bad Stuff

MAXIMUM PC VERDICT:
Our final judgement, awarded on a ten-point scale. Often brutal, always fair.

MAXIMUM PC VERDICT

Price $00
Company Techco, Inc.
Phone 800.888.8888
URL www.techco.com

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TEST LAB

KICKIN' THE TIRES ON THE LATEST HARDWARE AND TAKIN' THE LATEST SOFTWARE OUT FOR A SPIN

Hardware Photography by
AARON LAUER

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IBM Aptiva E3N

IBM's K6-2 leaves no room to maneuver

The E in E3N must stand for exhausted.

PLUSES
Better than average software bundle
Tiny, cute case

MINUSES
Itsy bitsy upgrade options
Lackluster performance

IBM should have shipped the E3N case welded shut, because there's no reason to open this unremarkable near-$1,000 machine.

While it sports AMD's hot K6-2 with 3DNow! at its heart, the E3N's incredible lack of upgrade options and lackluster performance is for those who want the comforting embrace of Big Blue's support infrastructure and never, ever, plan to pop the hood.

Inside, the E3N wins for the fewest PCI slots we've ever seen on a MicroATX motherboard. It has just one PCI slot open for upgrades—and that's shared with the lone open ISA slot. If you want a second internal drive, you'll have to use the sole open external bay-a 3.5-inch bay.

While upgrades may not matter to most computer newbies initially, upgrade options in PCs become a way of life as your sophistication and requirements increase. When little Timmy wants to play that new 3D game on Christmas morning, he'll be heartbroken. Want SCSI, better 3D graphics, wireless network card, or more RAM? All these will smash you into an artificial ceiling.

IBM tries to make up for the lean system with a plush software bundle and put *SmartSuite 97* in the box. IBM also includes a full version of *Norton Antivirus 4.0* that lets you upgrade virus definitions with a click of a button, a customized IBM Update Connector for driver and software updates over the Internet, and a full set of configuration and trouble-shooting tools from Watergate Software.

Notably missing from the bundle are any serious games. That's probably because IBM realized the E3N falls flat on its face in gaming. Pushing the E3N through our basic *Forsaken* benchmark almost gave it a heart attack, and it failed to run the *Quake II* test. The fault lies with the ATI Rage Pro videocard chipset. Not the strongest video to begin with, the Rage Pro had its abilities further crippled because IBM included only 2MB of video RAM. To compound the problem, the video is embedded on the motherboard. Why tie a CPU specialized for 3D gaming to a crippled video chipset?

Not all was bad in the E3N. The tiny 15-inch IBM monitor had full-featured geometry controls and turned in a solid viewable image at 1024x768. Its score of 90 in SYSmark 98 marks it as a low-end performer, but more than adequate for most office apps. The Sanyo CD-ROM was on par with other 32x "max" CD-ROMs. In the sound department, the no-name 3-watt speakers were about average for cheap speakers. IBM chose to supplement the Cirrus Logic Crystal soundcard on the motherboard with wavetable software from Yamaha. While Yamaha's host-side wavetable sounds fine, you'll take a performance hit. While the Bigfoot hard drive oddly bombed our HD Tach test, we know previous models turn in adequate performance. The plentiful RAM was a bonus, but IBM chose to cheap out and put in two 32MB DIMMs instead of a single 64MB DIMM.

In upgrades and performance, the CTX we examined in the September issue would kick the E3N's butt and take its name. Unless you prefer IBM's solid support to upgrades, gaming, and hardware heaven, the E3N won't be your cup of tea.

—Gordon Ung

UNDER THE HOOD

THE BRAINS

CPU	AMD 300MHz K6-2 with 3DNow!
L2 Cache	512K
RAM	64MB PC100 SDRAM (expandable to 256MB)
Motherboard	IBM V70MA-CR
Drive Bays	Two 5.25-inch, two 3.5-inch
I/O Ports	Two USB, two serial, one parallel, one gameport

DISPLAY

Videocard	ATI Rage Pro
Monitor	15-inch IBM
Res/Refresh	1024x768/60Hz

STORAGE

I/O	EIDE on motherboard
Hard Drive	6GB Quantum Bigfoot
CD/DVD	Sanyo CDR-1332
Removable	1.44MB floppy
Fax/Modem	56K Win modem

SOUND

Sound	Cirrus Logic Crystal 4235
Speakers	3-watt

THE BUNDLE

Windows 98 | Lotus SmartSuite 97 | Norton Antivirus 4.0 | Ring Central | Netscape Navigator | Config Safe | PC Doctor Diagnostics

BOOT 1:40 DOWN 0:07

BENCHMARKING

REAL WORLD

CPU/MOTHERBOARD bootMark		102
WINDOWS APPS SYSmark 98	official score	90
HARD DRIVE HD Tach	MB/sec	N/A (did not complete)
CD-ROM CD Tach98	drive rating	20.6x
3D RENDERING Newtek Inspire3D	sec	1138
DESKTOP PUBLISHING Adobe Photoshop 5.0	sec	190
DIRECT3D ForsakenMark	fps	— (failed to run)
OPENGL Quake2 v3.15	fps	— (failed to run)

MAXIMUM PC VERDICT

Price $1,250
Company IBM
Phone 888.411.1932
URL www.pc.ibm.com

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EXPANSION NOTES

IBM's plans for expanding the E3N are simple: buy a bigger Aptiva. Besides a Zip drive and one ISA or one PCI, you'll have to turn to the USB ports or pricey external drives for add-on components.

IROS

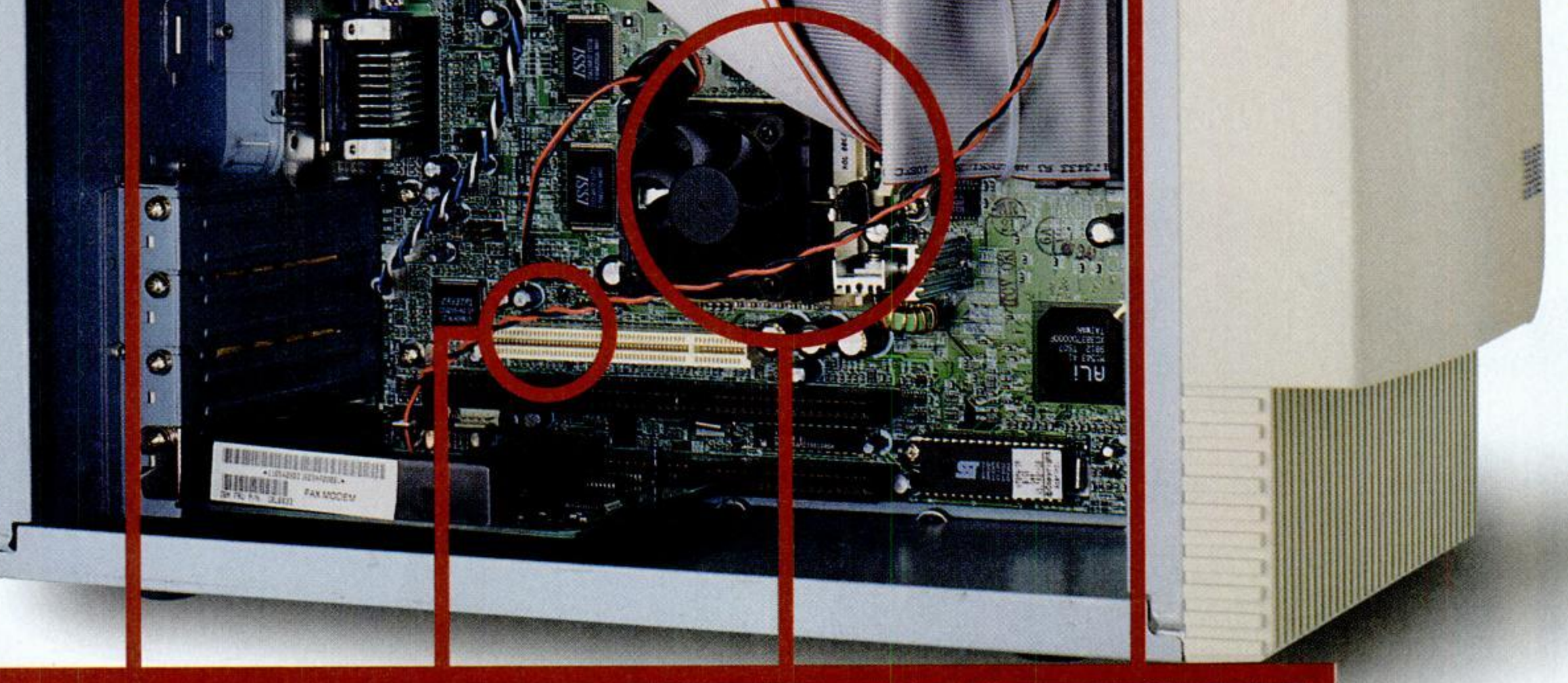
00	System timer	08	System clock
01	Keyboard	09	ACPI
02	IRQ controller	10	Soundcard
03	COM 2 port	11	Soundcard
04	LT Win modem	12	PS/2 mouse
05	USB controller	13	Num data proc
06	Floppy port	14	PCI IDE controller
07	Printer port	15	IDE controller

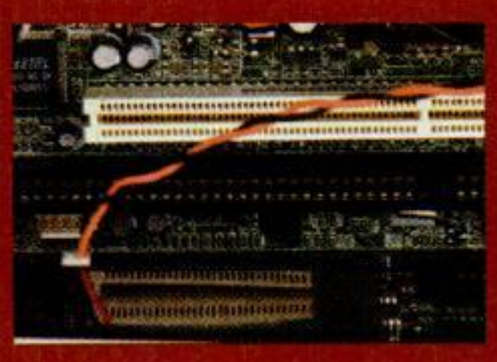
EXPANSION MAP

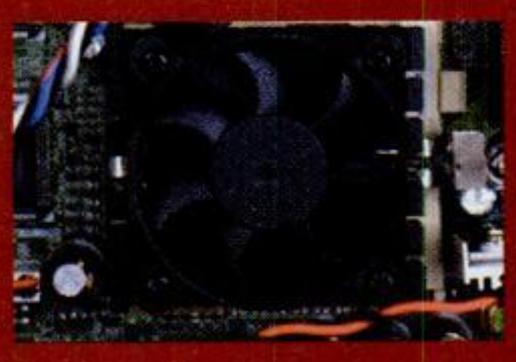
PCI	Open
ISA	Open
ISA	56K Modem

DMAS

00	Soundcard	03	Soundcard
01	Printer port	04	DMA controller
02	Floppy		







Bad Match You'll be outraged if you try any serious gaming with the meager 2MB Rage Pro.

PC or PlayStation? This MicroATX was so barren of slots we thought it was a PlayStation inside.

K6-2 in the House Even AMD's stellar K6-2 couldn't save the E3N from itself.

Big Waste The Bigfoot's low cost and large profile will annoy you big time if you ever need more expansion bays.

For definitions of Terminator words, hyperlink to the back of Maximum PC, or check out the Terminator online at www.maximumpcmag.com.

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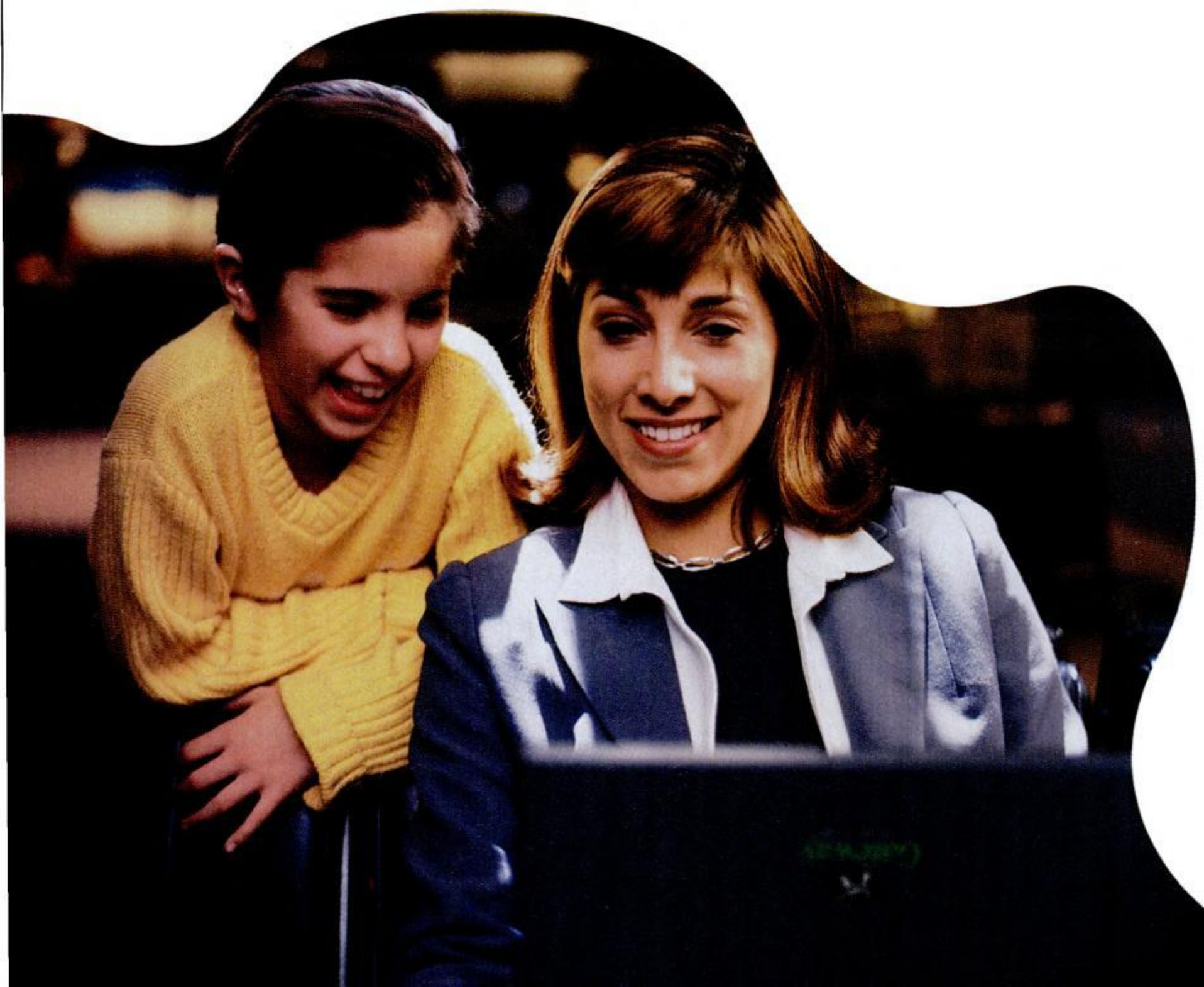
Let's talk about the ultimate traveling companion.

On the road again? We'll build you a portable with all the power and features of a desktop PC. So you can do spreadsheets, send e-mails, make presentations and more, to make you just as productive as back at the office. You can even play games and watch DVD movies to make traveling more fun. The Solo® 2500 and 9100 each won the August '98 ***PC Magazine*** **Editor's Choice** award, and the Solo 2500 won the magazine's **Best Buy Award** as well. With the best portables on the market, it's just one more reason why customers who buy another computer come home to Gateway.



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Every Gateway client is unique, and so is every Gateway PC. The systems here are just examples of what we can build for you.

King of the Road Solo 5150LS

- 14.1" XGA TFT Color Display
- Intel® Pentium® II Processor 233MHz with 512K Cache
- 64MB SDRAM (expandable to 160MB)
- 2.5MB 256-Bit Graphics Accelerator
- Modular DVD-ROM II Drive & 3.5" Disk Drive
- 4GB Ultra ATA Hard Drive
- Lithium Ion Battery W/Bty Gauge & AC Pack
- 2 USB Ports, CardBus & Zoomed Video Support
- NTSC/PAL Video Output
- Integrated 16-Bit Sound & Stereo Speakers
- TelePath® 56K[1] Modem for Windows
- Deluxe Leather Case
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- Microsoft® Windows® 98 & MS® Office 97, Small Business Edition plus Bookshelf® 98
- LapLink® V.7.5 for Windows 98 & McAfee® VirusScan
- Gateway Gold℠ Service[2] for Portable PCs
- As low as **$81/mo.** for 48 mos. or $2899[3]

The Portable Desktop Solo 9100LS

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- Intel Pentium II Processor 266MHz with 512K Cache
- 64MB SDRAM (expandable to 192MB)
- 4MB SGRAM 3-D Graphics Accelerator
- Modular DVD-ROM Drive & 3.5" Disk Drive
- 6GB Ultra ATA Hard Drive
- Lithium Ion Battery & AC Pack
- 2 USB Ports, CardBus & Zoomed Video Support
- NTSC/PAL Video Input & Output
- 16-Bit Wavetable Sound & Altec Lansing® Speakers
- TelePath 56K[1] Modem for Windows
- Deluxe Leather Case
- EZ Pad Pointing Device
- Microsoft Windows 98 & MS Office 97, Small Business Edition plus Bookshelf 98
- LapLink V.7.5 for Windows 98 & McAfee VirusScan
- Gateway Gold Service[2] for Portable PCs
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Kensington® Saddlebag ($79)

MS Professional Resource Suite ($99)

PC Card Modem with Cellular Support ($50 upgrade from Winmodem)

Kensington Master Lock® ($39)

gateway.net℠ $14.95/mo.[4]

Frequent Flier

Solo 2500SE

- 12.1" TFT Color Display
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- 2GB Ultra ATA Hard Drive
- NiMH Battery & AC Pack
- USB Ports, CardBus & Zoomed Video Support
- NTSC/PAL Video Output
- Integrated 16-Bit Sound & Stereo Speakers
- TelePath 56K[1] Modem for Windows
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SLICING AN IMAGE

If you have a large image that needs only parts of it updated regularly, or if you want to break up the image to assign hyperlinks, as opposed to using an image map, you can slice it.

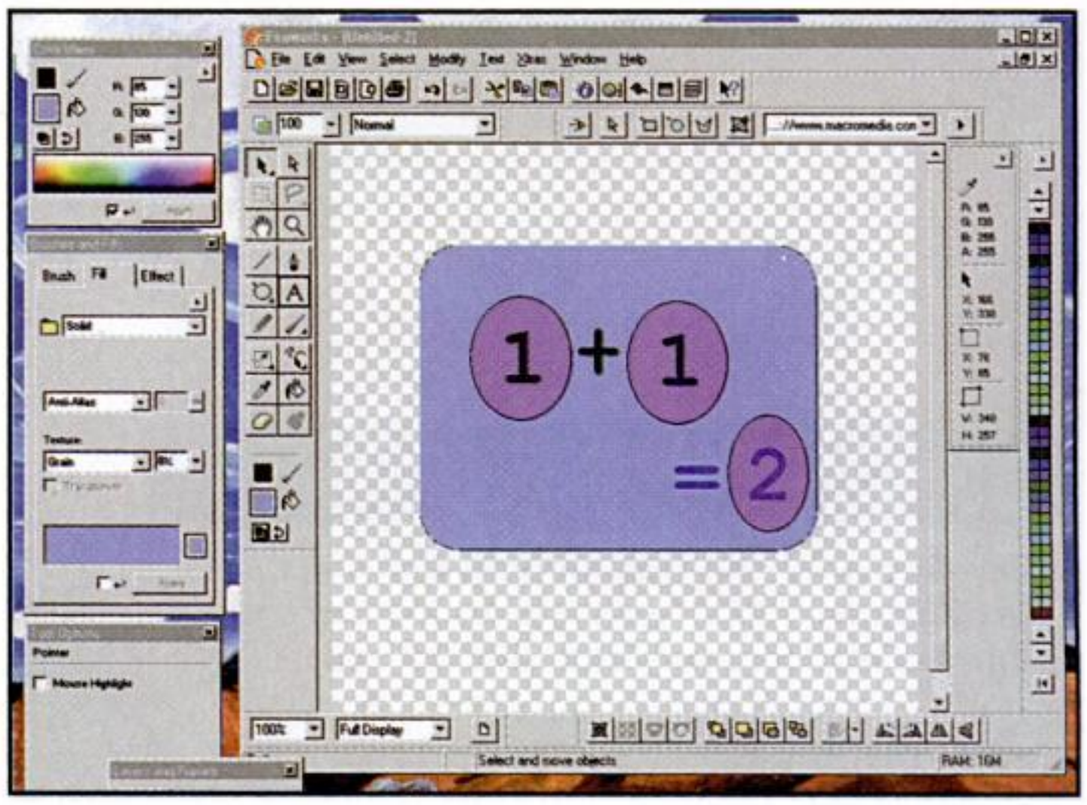
- Open an image: File > Open
- Use the Slice tool to draw squares over the areas you want sliced and exported as individual images.

- Set the properties, which includes assigning URLs. Select here whether it is a standard image or Javascript rollover. You can also preview your slices. You can have the image auto-named, which will just add a numeric sequence to your original name, or you can rename it (to make it less cryptic for future designers).

- Export the image: File > Export Slices. A dialog box will open.
- In the dialog box you decide whether you want to put images in a subfolder separate from the HTML file, which keeps things clean and organized. You can also create Javascript HTML files to preview all the states of Javascript rollovers.
- Export, then cut and paste the HTML code for the image table into your existing HTML document.

Fireworks

Create impressive web graphics

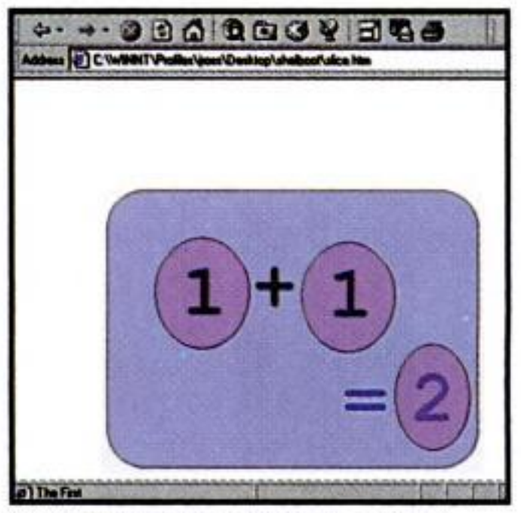


A standardized interface design makes learning Fireworks as easy as using it.

If you're strictly a web-based graphic designer, sell your copies of *Illustrator* and *Photoshop*—*Fireworks* does it all and then some. This web-authoring utility not only lets publishers create and edit both vector and pixel images, it also produces images with Javascript rollovers, URL assignments, intelligent complex tables, image maps (client and server side), and even the HTML code.

The first thing that impressed us is the use of text and objects. Every item on the screen is editable as both an object (vector) and a graphic (pixel). Intelligent use of line and fill, for instance, can create air-brush effects that remain movable objects, without the use of layers. You can change color, shape, and opacity, or send the object to front or back. Text can have textures added to it without converting it to vectors first. And after you've put text on the page, there's no need to erase and redo, or depend on layers to preserve the type path just to change the text color.

The *Fireworks* palette has those 216 magic "browser safe" shades that work on both PC and Mac—no shareware or plug-ins needed. The WebSnap Adaptive palette (the one that converts nonsafe colors to the browser-safe colors) sports an excellent matching scheme. And of course, there's a custom palette option for you rebels. Graphics compression is done through the Export window, which opens up to four windows with different compression settings, and allows you to choose the best image at the lowest compression, save these settings, and apply them to other graphics or folders as a batch process later. Very cool.



Here's the finished image in IE 4.0. It's under 9K, but 300 pixels by 300 pixels.

Effects? Save your enthusiasm. While Live Effects does make it easy to whip out quick images with blurs and drop shadows (kudos for the drop shadows), that's about all that comes free. We want more!

Fireworks has stuck to industry interface standards. If you're familiar with *Photoshop* or design programs in general, you'll quickly pick up how the application deals with cuts, paints, drags, layers, and tool palettes. While shareware tools to make animations and image maps have been excellent tokens of web wonderhood, the fact is, their cryptic user interfaces are nothing compared to the smoothness most designers are used to working with. The *Fireworks* animation tool works like any standard high-end animation tool, but is built for web animations, so it accounts for transparency, URL assignments, and compression from the get go. And if you've ever spent ridiculous hours slicing a large image into an HTML table of dizzying height and width specifications, you'll love the slicing capabilities. Assigning a URL is as simple as drawing a box, and the nifty color coding option keeps your URL assignments in order. And the Javascript code for the rollovers is clean, easy, and compliant with Netscape *Navigator* and *Internet Explorer* 3 and 4.

Fireworks is a useful alternative for people who can't afford both *Photoshop* and *Illustrator*. But before it's a replacement for both those applications, *Fireworks* still has some work to do.

—Shel Kimen

THE SPECS

REQUIREMENTS
- Pentium 120MHz
- 60MB+ hard disk space
- 32MB RAM (Win95)
- 40MB RAM (WinNT)
- 640x480 resolution and 256-color monitor

RECOMMENDED
- 100MB hard disk space
- Pentium 166MHz
- 1024x768 resolution and millions of colors

PLUSES
- Solid-image creation/editing tool
- Slicing and URL assignment easy
- Clean Javascript code
- Photoshop plug-in support
- Live Effects, kudos for the drop shadows!

MINUSES
- Not enough standard image effects
- Export windows complicated and cluttered
- Ate up processing power

MAXIMUM PC VERDICT

Price $299
Company Macromedia
Phone 800.457.1774
URL www.macromedia.com

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Strata Studio Pro 2.5

Beware the gremlins

With the latest version of *Studio Pro*, Strata tries to leap the chasm from a Mac world to full Mac/PC parity. Currently, version 2.5 supports Windows NT, but with the next update, Strata will add support for Win98.

The program menus and screens sit atop the Windows desktop without an obscuring background. No great problem if yours is uncluttered. But if it's covered with icons (like ours), you may find yourself confused which icons belong to *Studio Pro* and which to Windows. Strata says this "feature" is by design.

THE SPECS

REQUIREMENTS
486 processor
32MB RAM
40MB hard disk space
Windows NT 4.0
Quicktime 3.0

PLUSES

- Plenty of shapes, textures, and backgrounds
- Sectional renderer saves time
- Fast radiosity renderer
- Bezier editing of keyframes produces realism

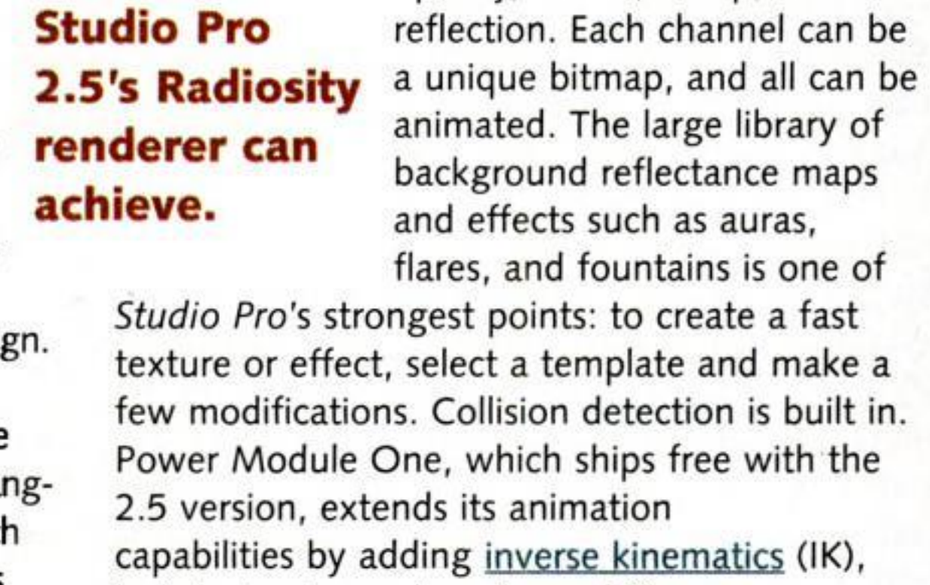
MINUSES

- PC version is flaky
- Basic renderings have "paint by numbers" look
- Price high for feature set
- No NURBS support

Another "feature" is "proportional scaling of time markers," which implies changing the elapsed time in which an animated sequence takes place. It really means moving several contiguous event markers to a new location on the timeline—a misleading statement. Four different keystroke combinations (obtained from tech support) failed to move them.

These problems aside, the interface feels similar to *Ray Dream Studio*'s: a drag-and-drop library of textures, shapes, effects, gels, and backgrounds accessible by tabs and scrolling horizontally; a selective renderer for showing small parts of the image; and a single-view window for modeling. *Studio Pro*'s window, on the other hand, can be subdivided into horizontally tiled perspective windows.

Traditional polygon mesh modeling using vertex movement or bezier control-point deformation are supported, as are lathing and extruding. Metaballs are also included, but NURBS are not. The included Extensions Tool Palette extends *Studio Pro*'s capabilities with deformation lattice modeling, Boolean functions, path extrusion, and skinning tools.



This male figure shows the detail Studio Pro 2.5's Radiosity renderer can achieve.

The texture-creation tool is especially complete, sporting 11 channels including glow, opacity, stencil, bump, and reflection. Each channel can be a unique bitmap, and all can be animated. The large library of background reflectance maps and effects such as auras, flares, and fountains is one of *Studio Pro*'s strongest points: to create a fast texture or effect, select a template and make a few modifications. Collision detection is built in. Power Module One, which ships free with the 2.5 version, extends its animation capabilities by adding inverse kinematics (IK), hair, hotspots, and smoke and fire.

The IK extension uses traditional boning techniques: create the bone structure, attach the mesh to it, specify parameters for motion constraints per axis per bone, and drag to set keyframe positions.

The Project Window (the keyframe editing area) lets you specify and cycle an animation sequence either in a loop or backward and forward without additional keyframes. This unit can then be copied and nested as desired to create subroutines without lengthy scripting.

Rendering speed varies depending on the settings used. We output a 510x332 pixel Targa file of a two-inch radius chrome sphere with one spotlight and a black background using the highest raytracing and radiosity settings. Rendering with high raytracing parameters took 6 seconds, and with radiosity settings, 9 seconds. Both *Studio Pro* images had the same fast, faked look.

Strata *Studio Pro 2.5* is a mid-level program with most features expected today in such an offering, but the PC version seems flaky. It also seems like too high a price for what you get, with programs such as *trueSpace* at almost one-third the price.

—Rick Stevens

MAXIMUM PC VERDICT

Price $1,495
Company Strata Inc.
Phone 800.787.2823
URL www.strata3d.com

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UP IN FLAMES

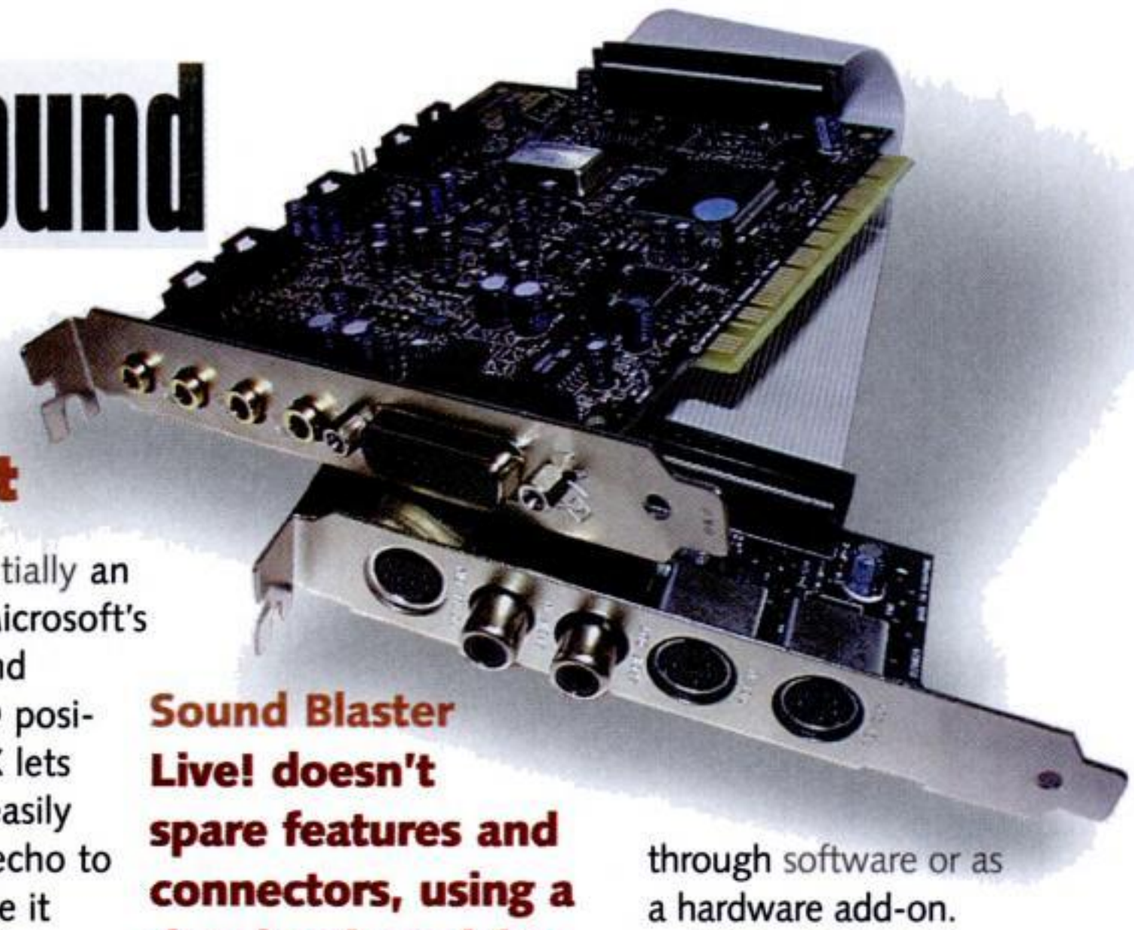
Here, we show you how to simulate a B17 with its engine on fire.

- Create a new scene by selecting File/New.
- In the Resource palette, click on the Shapes tab, the Acuris tab, then the Acuris B17 icon. Click Insert on the left side of the Resource palette to insert the B17 into the modeling window.

- In the Object Properties palette, click the transform tab, select Scale, click the Lock icon, select Percentage to scale by percent, then type 150 in the X box. The B17 is scaled to 150% of its former size.
- Click on the sphere icon in the toolbar and create a small sphere about the size of the engine housing. Position the sphere in the center of the engine housing raised above it at about 25% of the sphere's diameter.
- In the Resource palette, click on FX, then "fire & smoke." Select "orange plume." Click Edit on the left side of Resource palette. Set the "hot spot" to "Red Rumble" and angle to 45 degrees. Click OK.

- Select Render and specify RD Best for settings, renderer Radiosity, and texture-detail as Fine, then click on Render.

Creative Labs Sound Blaster Live!



Creative's finally on target

While upstarts such as Aureal captured the ears of gamers and PCI soundcards flooded the market, Creative Labs was not to be heard from. But Creative has actually been secretly working with E-Mu and Ensoniq to produce a card to restore Sound Blaster's good name. The Sound Blaster Live! is the real thing.

THE SPECS

SIGNAL/NOISE RATIO	
100dB	
FREQUENCY RESPONSE	
10Hz to 44kHz	
THE BUNDLE	
Drivers for Windows 95, 98, NT | Sound Forge XP 4.0 | Cakewalk Express Gold | Mixman Studio | Keytar | Prody Parrot	

PLUSES

- Realtime effects engine
- EAX presets for games that don't support it
- Support for 4, 6, and 8 speakers
- Resource friendly
- Polished control applets
- Solid software bundle
- 32MB of system RAM for SoundFonts
- Superb joystick support

MINUSES

- Stock general MIDI sets sound flat
- Digital I/O port connector cable too short

At the heart of the Sound Blaster Live! lies the 1,000 audio MIPS 10K1 processor. Designed for E-Mu's pro-level APS soundcard, the 10K1 offers realtime pitch shifting, reverb, and features not found elsewhere in consumer soundcards. Presets such as dizzy, dreamy, or psychotic bend sounds, and the interface lets you tailor settings. The Live! also routes sound from any source through the effects engine, including CD, MIDI, or WAV files.

With the Live!, Creative has also unveiled its EAX API. Essentially an extension to Microsoft's DirectSound and DirectSound3D positional API, EAX lets programmers easily add reverb or echo to a room to make it feel the right size. Creative uses a limited version of Epic's *Unreal* to showcase Live!'s reverb.

DARE TO COMPARE

SOUND BLASTER LIVE!	
% CPU UTILIZATION VIA DIRECTSOUND	
16 mixed signals *	9
24 mixed signals *	13
LEGACY REAL-MODE DOS SUPPORT (PASS/FAIL)	
Redneck Rampage	Pass
Terranova	Pass
GAME PERFORMANCE (FPS)	
GLQuake II (800x600 fps)	55
TurokMark (800x600 fps)	47
Unreal (640x480fps)	43
DIGITAL JOYSTICK COMPLIANCE	
Microsoft Force Feedback joystick, Thrustmaster Millennium Interceptor 3D, Thrustmaster Rage3D	
WIN98 SOUND FEATURE SET	
DirectSound accelerator, DirectSound 3D accelerator, Downloadable Sample Compliant (DLS), Adjustable sample RAM	
RESOURCES	
Two IRQ, two DMA	

* Using the DirectSound3D applet included in the DirectX 5.2 SDK, we played WAV files of various lengths and frequencies and monitored CPU utilization with system monitor.

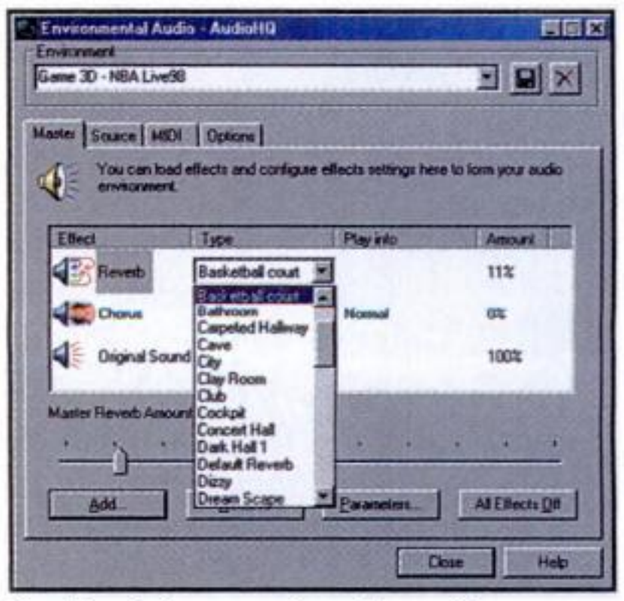
Creative has taken the time to tailor environmental audio presets for other games that don't directly support EAX, such as *Quake II* and *Age of Empires*. And DreamWorks, MicroProse, Epic, and Electronic Arts have signed on to support EAX in some titles.

The Live! accelerates eight DirectSound3D streams in hardware, but the upcoming Vortex 2 chip promises to accelerate 16 streams. Still, the Live! is no slouch with the current generation of games, showing no noticeable reduction in framerates. Although not fully A3D compliant, the drivers shunt A3D calls to DirectSound3D well enough for even the A3D-only game *Jedi Knight* to work effectively.

The card itself is chock-full of connectors. The main board sports two 1/8-inch outputs and inputs, as well as a standard MIDI/joystick port. Onboard, the card has connectors for analog modem, CD input, auxiliary input, digital zoomed-video I2S input, and CD S/PDIF digital input. Headers for volume control, PC speaker, and others litter the board as well. A second daughterboard hosts S/PDIF in and out, MIDI in and out, and digital DIN for use with Creative's upcoming eight-speaker set. Out of the box, the card supports a five-speaker system. Creative is also considering adding AC3 decoding either through software or as a hardware add-on.

Sound Blaster Live! doesn't spare features and connectors, using a daughterboard for additional connector madness.

Up to 32MB of system RAM can be locked in for MIDI SoundFont samples. The stock general MIDI sets, including the 8MB set, sound flat, but were still above average. And its 64-voice hardware wavetable set isn't just for MIDI. Creative's SoundFont technology lets you swap out or supplement the sets for specialized sounds available for download.



Creative lets you get creative with your reverb, echo, and auto-wah.

Creative has aimed this card not just at gamers, but at computer music enthusiasts and sound fanatics. With the ability to do realtime effects, a bevy of digital connectors, and budding support for EAX, the Live! is a winner even at its steep list price.

—Gordon Ung

MAXIMUM PC VERDICT

Price $199
Company Creative Labs
Phone 408.428.6600
URL www.sblive.com

10

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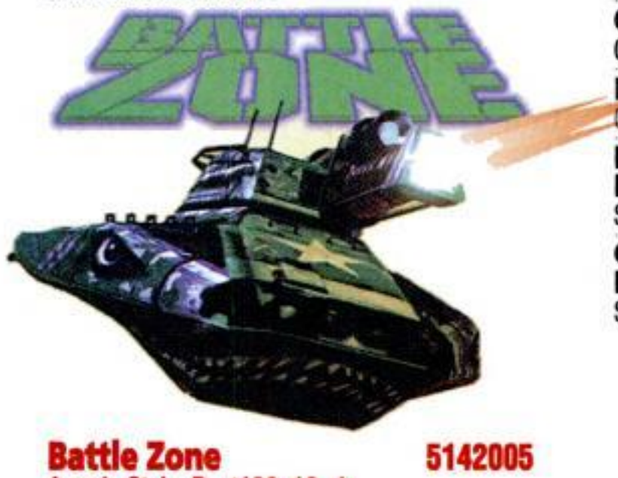

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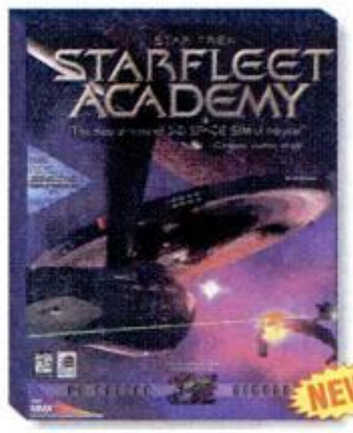

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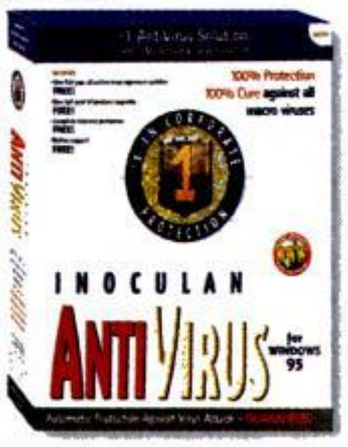

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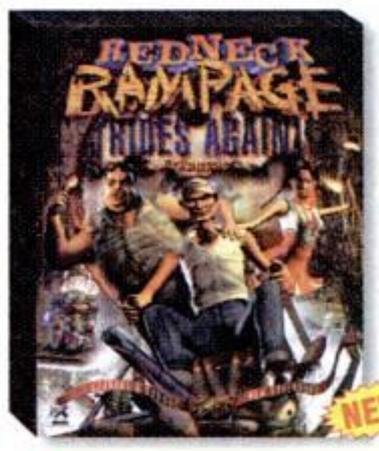

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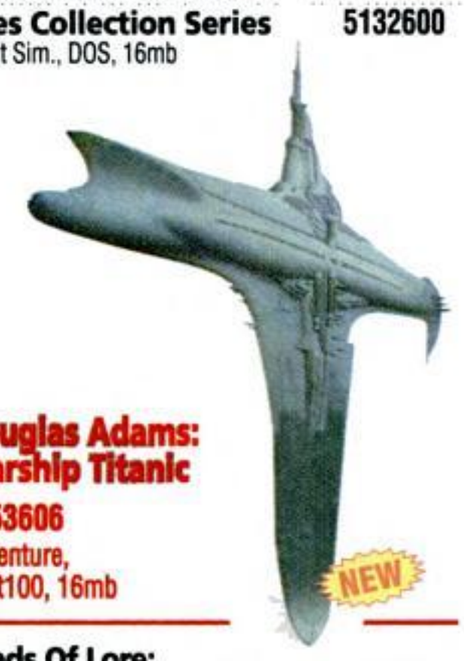

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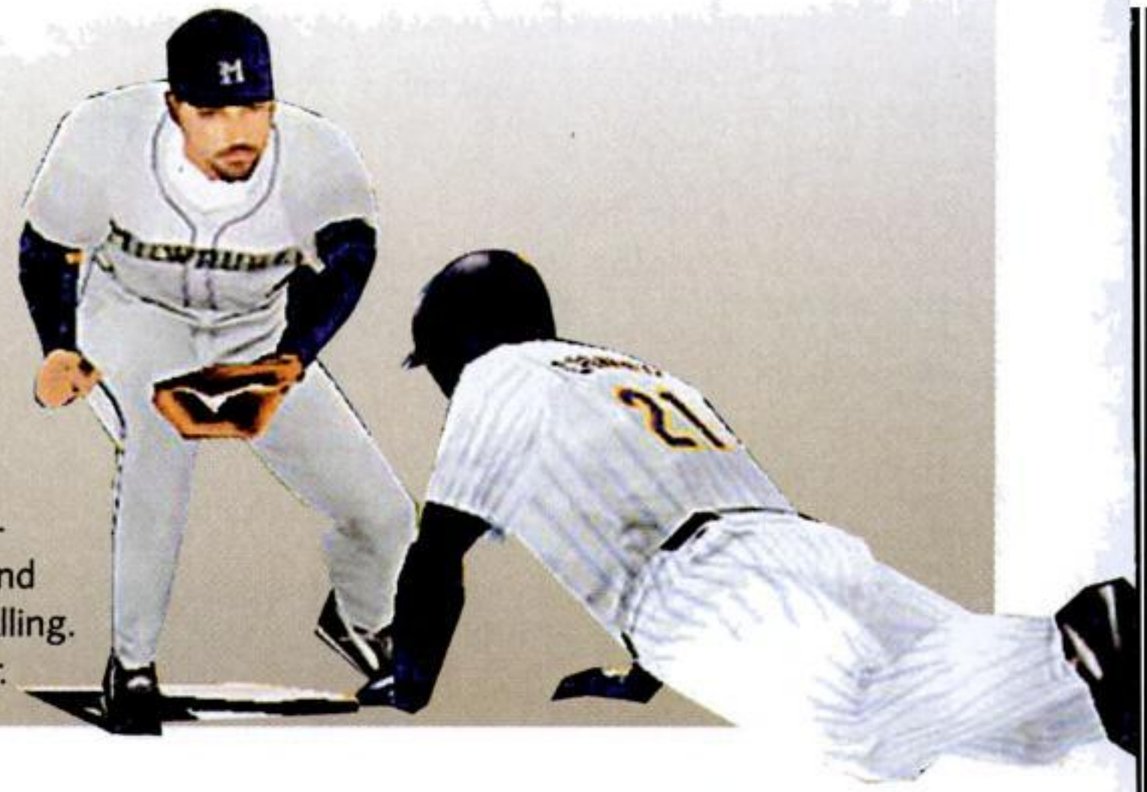
Play Ball!

One ball, one strike, one run

With summer rapidly drawing to a close, the sound of cracking bats and screaming announcers is becoming harder to hear on the trusty AM radio in your beater Dodge. Fortunately, these three contenders keep you swingin' and flingin' till the snow starts falling.

—Phil Lacefield Jr.



Triple Play 99

Triple Play 99 has eerily real stadiums and equally eerie player expressions.

At first, *Triple Play 99* looks maahvalous. The stadiums in *TP99* are rendered with frightening 3D accuracy, right down to the signs hanging behind home plate. A slick interface allows access to the dozens of control screens. Buck Martinez provides realistic and witty play-by-play, chiming in with stats and trivia when appropriate. The players look and animate pretty groovy as well, but then you start to notice something disturbing: they smile—all the time. No recognizable player faces here, just pixilated toothy grins. And although the overall motion is smooth, even at 800x600 res, the players' fielding movements can be jerky, as if the 3D coding doesn't mesh with the game engine.

Fortunately the robotic drones that pass for players are overshadowed by the bewildering array of optional features, such as hyper-detailed managerial control, home-run derbies, an accurate 1998 roster with downloadable updates, excellent AI, and more than 1,300 stats for each player. Internet play is a welcome new feature to this venerable series, control is easy with keyboard or gamepad, and the overall graphics are fairly unique in their accuracy and high quality. Zippy framerates and sexy textures take this baby clear out over the left field fence of your choosing. That ball is gone!

MAXIMUM PC VERDICT

Price $50
Company EA Sports
Phone 800.245.4525
URL www.easports.com

8

Hard Ball 6

Next on-deck is another veteran player. *Hard Ball* has been around almost as long as baseball has been on the computer, with its fair share of wins and losses, and version 6 leads the pack in visual quality. *HB6* looks like it means business, although stadiums aren't as accurate as they should be. Direct3D and most graphics cards are supported, but sadly, you can't tell the difference between software and hardware acceleration. Fortunately joystick and gamepad control are simple, and custom scheduling and interleague play add to the build-your-own excitement.

But hold on folks, looks like a fielding error by our star player. Play-by-play commentary by Greg Papa is spotty and inaccurate, often causing you to look twice when your play is miscalled. The heady control interface is at best balky and can take days to master. The camera angles are disorienting and random after hits, making fielding control difficult. And every player, on every team, looks exactly alike! Two years between releases should have paid off more than this, but *HB6* falls short this time up.

Caminiti slugs another long ball toward ol' the Cleveland skyline.

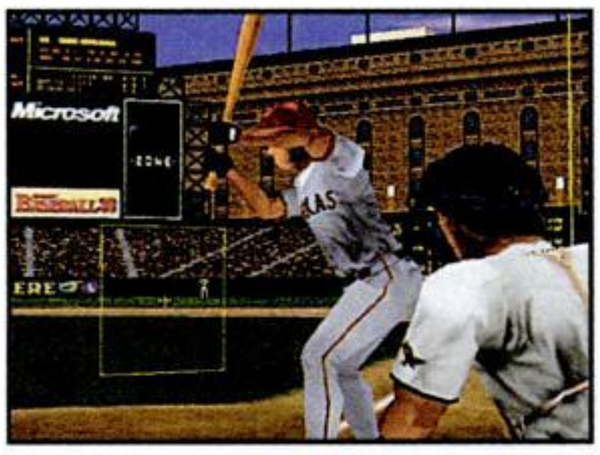
MAXIMUM PC VERDICT

Price $50
Company Accolade
Phone 800.245.7744
URL www.accolade.com

4

Baseball 3D

When the 300-lb. gorilla steps to the plate, people stop and watch. Now that the fine folks from Redmond have thrown their ballcaps onto the field with *Baseball 3D*, you better listen. 3D acceleration is mandatory, and for good reason, because *B3D* has the finest-looking Boys of Summer ever. 300-degree imaging puts the actual players' faces right onto their accurately sized and animated bodies, so you start to recognize these well-rendered guys. Uniforms, numbers, unique subtle movements—all there, all remarkably realistic at 25fps+. Stadium cameras follow the ball from grounder to second to first for the coolest double plays ever seen on a computer screen.



Stepping into the Zone at Camden Yards.

Too bad the same can't be said for the stadiums and details therein. Inaccurate interior renderings and flat, shady crowds are unacceptable with such high system requirements, and no amount of patching can save the awful stadiums, which look more wrecked than rendered. 800x600 resolution caused major frame-dropping and gameplay glitches, so the sexy smoothness of the lowly 640x480 res is the best you'll get. Head-to-head Internet play is a pleasant surprise, as are the excellent physics and control. This, along with Terry McDonald's seamless play-by-play and the automatic instant replay after home runs help make up for the visual screwballs.

MAXIMUM PC VERDICT

Price $55
Company Microsoft
Phone 800.947.4239
URL www.microsoft.com/games

6

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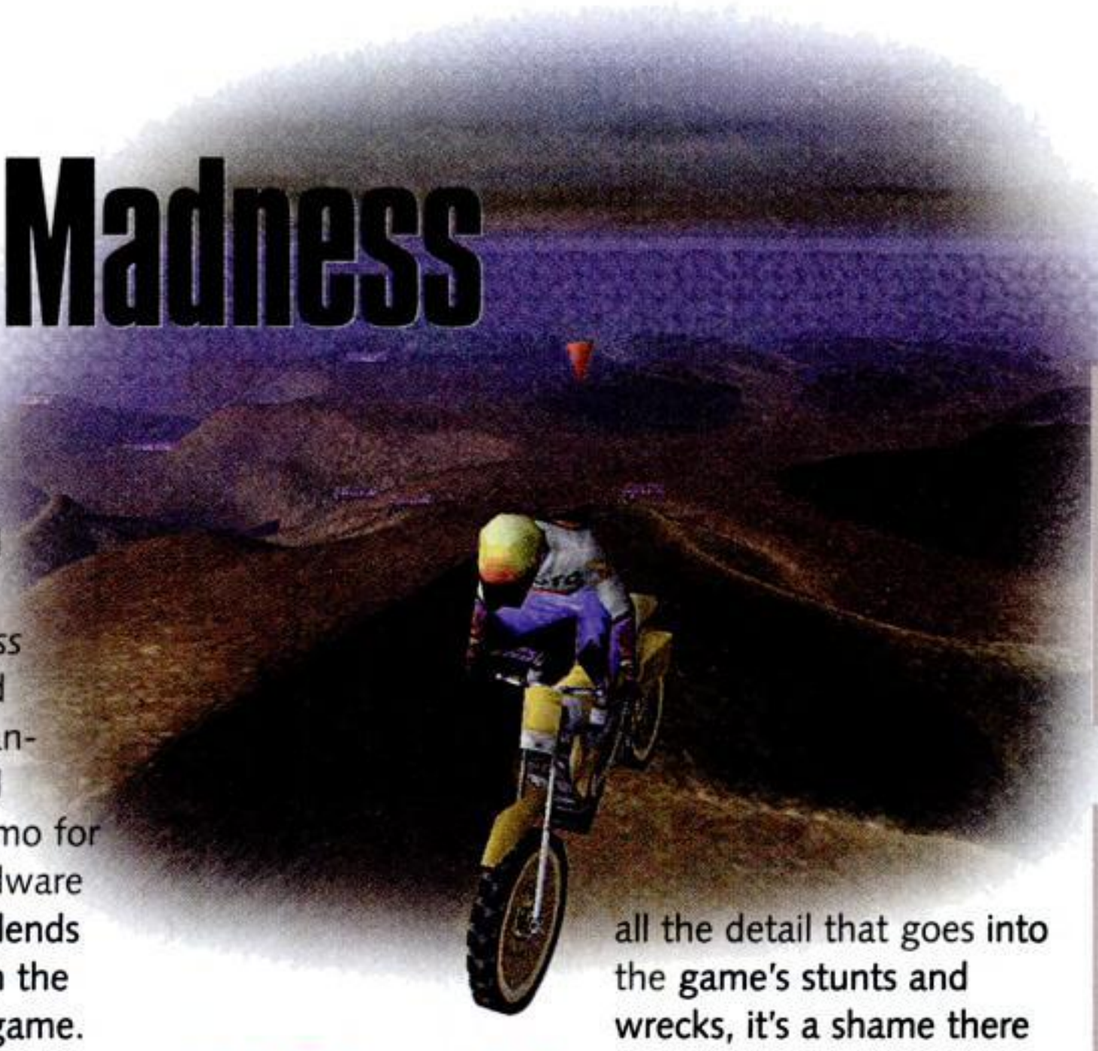
Motocross Madness

Talk dirt to me



High-flying aerial acrobatics give a glimpse of what the Aardvark terrain engine can do. We're talking flight-sim detail here.

With a gorgeous terrain engine, high-flying framerates, and a physics model realistic enough to make your knees buckle during a bad landing, *Motocross Madness* takes you a long way toward fulfilling your knobby-tired dirt-bike fantasies. Rainbow Studios has developed what was originally conceived as a demo for Microsoft's controversial Talisman hardware into a stunning graphics engine that blends the intricate terrain of a flight sim with the full-throttle arcade action of a racing game.

Rainbow's new Aardvark engine uses several techniques to keep terrain detail high while pushing visibility to the horizon. Using 1024x1024 texture maps, the engine pushes up to 4,000 polygons per frame while keeping terrain popup to a minimum using dynamic tesselation. Aardvark's terrain database performs on-the-fly analysis of every possible rendering angle and calculates polygon sets and level of detail (LOD) before the 3D card requests the data. The result is a terrain generator that'll make *Longbow 2* green with envy.

THE SPECS

REQUIREMENTS
- Pentium 133MHz with 4MB 3D card or P166 with 2MB 3D card
- Windows 95 or 98
- DirectX 5–compatible 3D accelerator card
- 16MB RAM
- 60MB hard disk space
- 4x CD-ROM

MULTIPLAYER
- TCP/IP (LAN/Internet)
- Direct Serial Connection

PLUSES
- Excellent terrain generator
- D3D renderer scales upward to hardware
- Believable physics model
- Nasty wrecks

MINUSES
- Limited to 16 stunts
- No instant replay
- Limited first-person view

The fancy graphics aren't limited to just the terrain generator. The chunks of dirt kicked up by each bike are courtesy of the game's particle generation system, and the perspective-correct, dynamically lit, raycast shadows accurately reflect rider animations, as well as indicate just how high you're really flying.

With four event types, over 56 tracks, and a track editor, Motocross Madness has plenty of terrain to tear up.

All this dirt-kicking, kidney-rattling fun is available for 3D cards only, specifically DirectX 5.0–compliant Direct3D hardware. The rendering engine scales upward depending on your 3D card—at 16-bit color with resolutions from 320x240 to 1600x1200 and beyond.

The view defaults to a chase camera that can be panned around the bike, but there's also a bird's-eye camera and a thrill cam that shows off your stunts with the best possible views. Our big complaint lies in the lack of instant replay. With all the detail that goes into the game's stunts and wrecks, it's a shame there isn't a way to save them.

The physics engine complements the graphics with advanced motion-capture techniques used to separately model the rider and bike. The rider's weight distribution and balance directly effect the handling of the bike, resulting in more realistic control over direction and tilt. And each shift in weight is reflected in detailed character animations. While spectacular, the 16 aerial stunts get tiresome, and there's no way to create new stunts. Far more impressive are the wrecks. Lose control of the bike and you'll find yourself uncontrollably flailing through the air before smacking into the ground violently.

The game's combination of fast framerates and precision control makes it a natural for a gamepad. When used in conjunction with Microsoft's new SideWinder Freestyle Pro, *Motocross Madness* becomes a real dirt-bike sim. Tilting the gamepad side to side makes you lean into turns as if you're holding onto mini handlebars.

For all of us who listened to our protective mothers and didn't spend all our paper-route money on a dirt bike, *Motocross Madness* is a second chance to kick up the dirt. The only thing missing is the occasional broken bone and the cool story of how you did it.

—Sean Downey

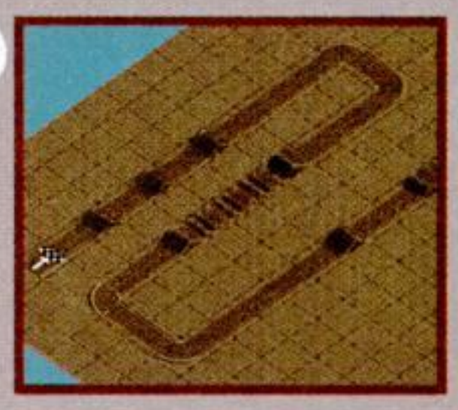
MAXIMUM PC VERDICT

Price $55
Developer Rainbow Studios
Publisher Microsoft
Phone 800.426.9400
URL www.microsoft.com/games

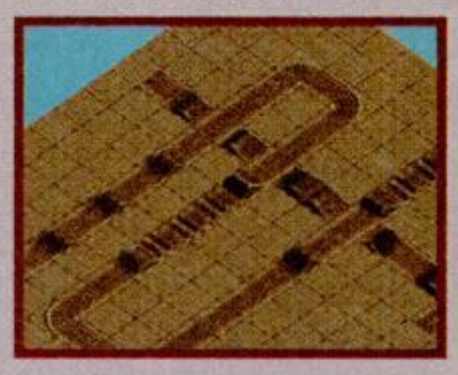
8

TRACK EDITING 101

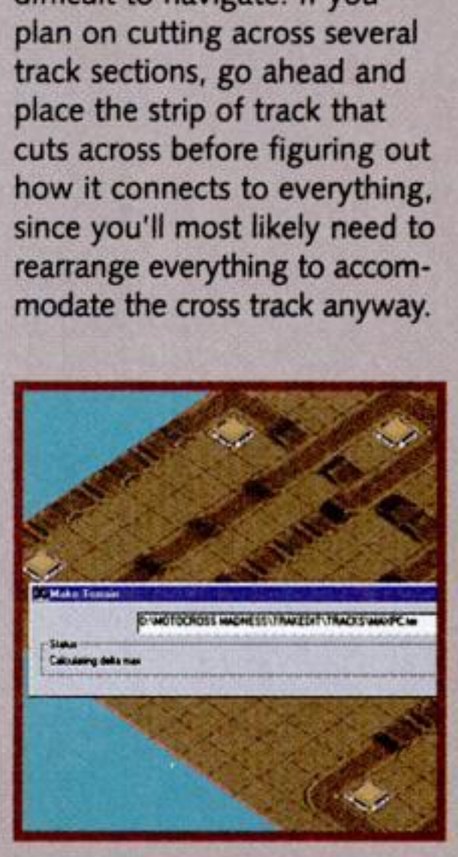
Motocross Madness ships with an easy-to-use track editor for creating and editing supercross tracks. The editor doesn't allow heavy terrain modification and limits you to only twelve course pieces, so it's more akin to a HotWheels racetrack than a full-blown world builder. Creating a good supercross course takes more than just laying down track, however.



You should have a good idea of the airtime and distance for the different jumps before placing them (think one to two spaces for small jumps and three to four for big ones). It's considered bad form to put a jump directly before a turn and just common courtesy to provide a landing ramp at the end of any big jump.



While it may be tempting to create sharp 180 degree turns for variety's sake, keep in mind that they make your track difficult to navigate. If you plan on cutting across several track sections, go ahead and place the strip of track that cuts across before figuring out how it connects to everything, since you'll most likely need to rearrange everything to accommodate the cross track anyway.



You won't be able to create the perfect track on the first try, so get used to compiling and re-compiling as you test your creations.

For definitions of Terminator words, hyperlink to the back of Maximum PC, or check out the Terminator online at www.maximumpcmag.com.

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Sony Spressa CDU928E 2x8 ATAPI

Two steps back and one step up

The Sony Spressa delivers a solid drive with disappointing software.

The venting holes on the top of the Spressa indicate it's a high-performance drive. This couldn't be further from the truth. It reads at 8x, which we don't contest. High interface burst speeds reaching 5.4MB are impressive for this CLV-based drive, but a random access time of 213ms keeps it spinning its wheels. The drive consistently delivered buffer underruns at 2x when connected to another CD-ROM drive on the same bus. We tested a mixed-mode disc, and it couldn't copy the first data track until we bumped it down to 1x. We retested using Adaptec's *Easy CD Creator* while connected to the same IDE bus, and it worked. It also copies fine at 2x when moved to the other IDE bus. So it's not the drive's fault. It performed well on all other tests and extracted Redbook audio files at 8x.

Sony CD Right!, from Prassi Software, supports CD copy, data CD-ROM recording, and audio CD compilation. Utilities that convert WAV files to CD quality, along with those that add fades and adjust volume properties, are also present. Sony doesn't include its CD-R File System (CDRFS) packet-writing software with its bundle, but it can be downloaded from Sony's web site. It took 2:23 minutes to format a disc and 45 minutes to fill it up. Once done, you must "freeze" the disc. This requires an additional 13.5MB of space and allows it to be read in CD-ROM drives that support fixed- and variable-packets. More data can be added at a later time, requiring it to be re-freezed (an additional 13.5MB).

If you're dead set on a 2x writer, this package is best with *Easy CD Creator*. But you're better off putting the extra money toward a faster burner.

—Sean Cleveland

THE SPECS

INTERNAL BUFFER	512K
INTERFACE	Bus-mastering ATAPI (EIDE)
RECORDING METHODS SUPPORTED	Track-at-Once, Mixed-Mode, Multisession, Fixed-Packet Writing, Variable-Packet Writing

PLUSES
- High interface burst rates
- Fast Redbook audio extraction

MINUSES
- Failed a write test with bundled software
- No Disc-at-Once support
- Slow random access speeds
- High space overhead with packet writing

DARE TO COMPARE

	SONY	MITSUMI
Drive Model	CDU928E	CR-280-1TE
RECORDING[1]		
Time to copy Maximum CD #1	01:14:00 (1x)	00:40:00 (2x)
Time to Partition CD-RW Disc	00:02:30	00:43:00
Disc space available after format (MB)	517	620
Time to fill disc using packet writing	00:45:00	01:29:00
CD TACH[2]		
Drive rating	8.1x	8.0x
Avg. 16K sequential read (MB/sec)	1.2	1.2
Min. 16K sequential read (MB/sec)	1.2	1.2
Max. 16K sequential read (MB/sec)	1.2	1.2
Full stroke access time (ms)	315	301
Random access time (ms)	213	175
4x CPU Utilization	1%	1%
8x CPU Utilization	3%	2%
2K Interface burst speed (MB/sec)	2.0	1.9
8K Interface burst speed (MB/sec)	4.3	1.6
16K Interface burst speed (MB/sec)	5.4	1.5
REDBOOK AUDIO EXTRACTION[3]		
Extraction speed	8x	2x
Extraction quality	Excellent	Excellent
REAL-WORLD COPY[4]		
Time to copy	00:11:42	00:11:34

[1]Real-world burn testing. [2]Performs a full benchmark assault on CD-ROM drives. [3]Converts CD Audio to a WAV file. [4]Time it takes to copy Maximum CD 01 to hard drive.

MAXIMUM PC VERDICT

Price $329
Company Sony
Phone 800.352.7669
URL www.ita.sel.sony.com

5

MITSUMI CR-2801TE 2X8 ATAPI

The Mitsumi CR-2801TE has a few holes, yet keeps the juices in.

Mitsumi delivers a solid 2x drive that took everything we threw at it with aplomb. It also successfully performed the 2x recording test that Sony failed, most likely due to the bundled *Easy CD Creator Standard Edition*. Read speeds are solid at 8x, and its random access time is better than the Spressa's, coming in at 175ms. The interface burst speeds were anemic though, coming in at one-quarter the speed. But the 2801TE falls short when it comes to Redbook audio extraction. The 2x speed is the most pathetic we've seen to date.

The CR-2801TE comes with Adaptec's *DirectCD 1.01*, which uses variable-length packet writing for drag-and-drop copying like a hard drive. *DirectCD* doesn't come with the overhead that Sony's CDRFS does, but it's slow as molasses. It took an hour and a half to copy 620MB to a disc.

Our advice: save up an extra hundred bucks and get a 4x burner.

MAXIMUM PC VERDICT

Price $299
Company Mitsumi
Phone 800.648.7864
URL www.mitsumi.com

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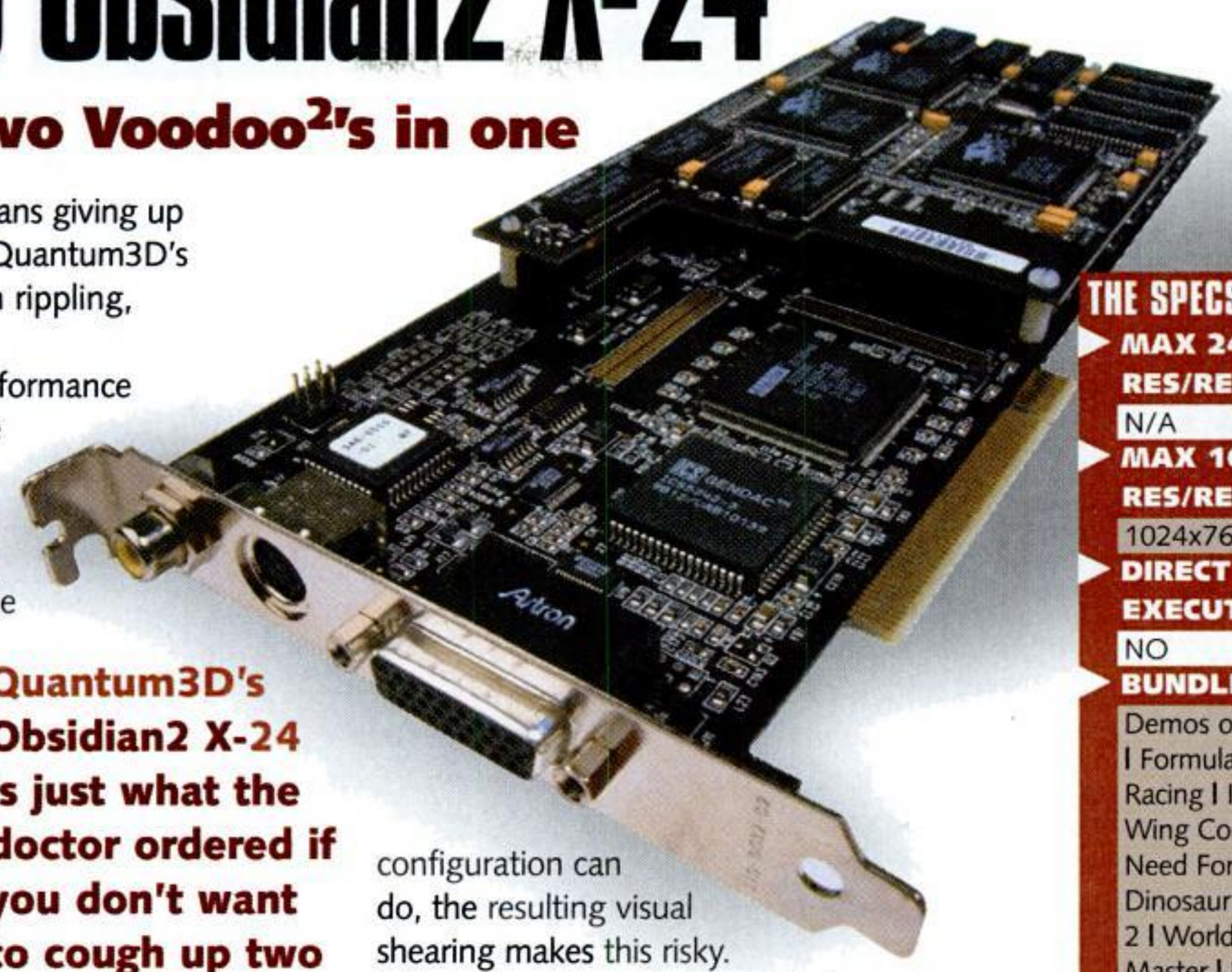
Quantum3D Obsidian2 X-24

It's two... two... two Voodoo²'s in one



Dual-SLI Voodoo² mischief usually means giving up two precious PCI slots, but not with Quantum3D's Obsidian2 X-24, the latest exercise in rippling, realtime 3D-rendering power.

Based on 3Dfx's Voodoo² (the performance standard everyone's gunning for), the Obsidian2 X-24 is the first Voodoo² board to harness the raw silicon power of a dual-Scan Line Interleave (SLI) Voodoo² configuration in a single PCI board.

Total local video memory weighs in at 24MB, with 4MB of 100MHz Silicon Magic EDO RAM on the pixelfx2 chip and 4MB per texelfx2 chip on the mainboard. The second daughterboard provides the other 12MB and accompanying 3D processors.

Quantum3D's Obsidian2 X-24 is just what the doctor ordered if you don't want to cough up two PCI slots for dual-Voodoo² delight.

With the Obsidian2 X-24 being its flagship Voodoo² part, Quantum3D added all the features you could want, including a Chrontel-powered composite and S-Video TV-output at 640x480 and 800x600.

Unlike most companies shipping Voodoo², Quantum3D tweaks and optimizes its drivers beyond reference specs, and the Obsidian2 X-24's control panel showcases this. An overclocking slider capable of pushing the memory speed up to 100MHz and in-depth TV-output adjustments make the control applet a joy to tweak. But why Quantum3D decided on limiting the refresh rate for 640x480 and 800x600 to 85Hz blows our minds—every other Voodoo² board allows refresh rates as high as 120Hz at these resolutions.

Performance scores at the default 92MHz memory speed are castrated. 800x600 *Forsaken* sauntered in at 84.46fps—clearly limited by the 85MHz refresh rate. While disabling the V-sync bumped framerates up to the 100fps+ a dual-SLI configuration can do, the resulting visual shearing makes this risky. Otherwise, 3D performance is tres sexy, with a solid 45.6fps at 800x600 *Battlezone*, and a muy bien 65.2fps at 1024x468 *Quake II*. Rendering quality is typical Voodoo² fare, but make sure you have the latest drivers to alleviate high-res D3D visual problems.

While you can push the memory speed up to 100MHz, the rig emits mondo heat even at its default setting—so much that we wouldn't recommend overclocking without some type of heatsink/fan combo keeping the cooling peace. This should have been built in.

TV output is also splendid. But unlike Canopus's Pure 3D II, you cannot view your 2D output on your TV. Also, the Pure 3D II supported lower resolutions such as 512x384 and others. The Obsidian2 X-24 stays locked in at 640x480 and 800x600.You can have both monitor and TV pumping at the same time, but the TV output will dim when the card's forced to drive both outputs.

Despite its premium pricing and refresh-rate castration, the Obsidian2 X-24's single PCI slot status, kewl features galore, and sufficient horsepower will beat those polys into 60fps submission.

—Andrew Sanchez

THE SPECS

MAX 24-BIT RES/REFRESH RATE
N/A

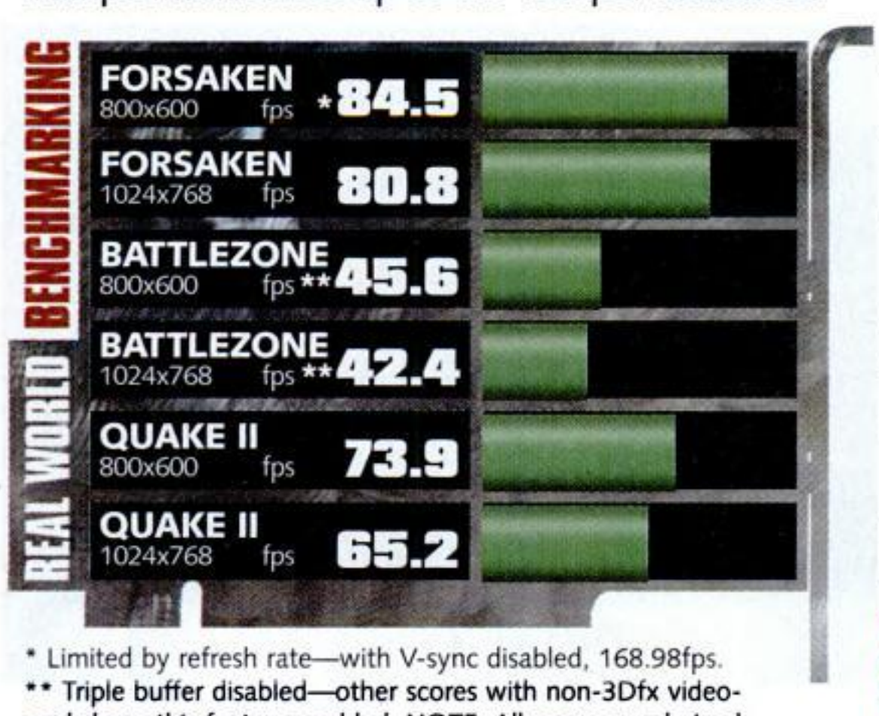
MAX 16-BIT RES/REFRESH RATE
1024x768/85Hz

DIRECT MEMORY EXECUTION?
NO

BUNDLE
Demos of: Barrage | G-Police | Formula 1 Championship Racing | Incoming | Forsaken | Wing Commander Prophecy | Need For Speed II SE | Turok Dinosaur Hunter | Longbow 2 | World Cup 98 | Shadow Master | Nuclear Strike | Shipwreckers | Wipeout XL

VISUAL QUALITY

BENCHMARKING



* Limited by refresh rate—with V-sync disabled, 168.98fps.
** Triple buffer disabled—other scores with non-3Dfx videocards have this feature enabled. NOTE: All scores are derived with V-sync enabled.

PLUSES

- Dual-SLI Voodoo² in one PCI board
- 24MB of EDO DRAM
- Overclockable to 100MHz
- Automatic 60MHz refresh rate lock-in for TV output

MINUSES

- Performance hampered by 85MHz max refresh rates
- No 2D TV output
- Only does 640x480 and 800x600 TV output
- Runs hot
- Big 3/4 length PCI slot required

MAXIMUM PC VERDICT

Price $600
Company Quantum 3D
Phone 888.747.1020
URL www.quantum3d.com

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Gateway G6-450

Finally! A machine with a CD-R!

Gateway gets serious with its newest behemoth, throwing a little of everything in to please the masses.

PLUSES
- Includes CD-R/RW drive
- Full DVD hardware kit
- Voodoo² 3D accelerator
- 14GB Ultra DMA hard drive
- Fat software bundle

MINUSES
- No TV-out
- 200-watt power supply
- Only 64MB of RAM
- Lackluster soundcard

Gateway's pushing the boundaries of desktop PCs, and the G6-450 is a testament to its efforts. Powered by an Intel architecture, the G6-450 uses a Pentium II 450MHz that rides the Tabor motherboard. The Tabor's built exactly like the Seattle SE440BX board, except it replaces the Crystal Sound chipset with Creative Labs' Sound Blaster AudioPCI 64V sound chipset.

But a stroke of creative genius sets this machine apart. By bundling Philips CDD3610 CD-R/CD-RW drive (the first machine we've seen do this on a large scale), Gateway proves that CD-ROM duplication and rewritability aren't niche anymore; they're ready for the masses. Adaptec's *Easy CD Creator Standard Edition* duplicates data and audio CDs and is a good way to back up data. *DirectCD*, another Adaptec creation, supplies packet-writing support that makes writing to discs a drag-and-drop process. The CDD3610 uses fixed-length packet writing and supports random erasability, so deleting files actually frees up space. CD-RW, in real-world terms, works like a floppy, but takes more than 50 minutes to format, has an overhead of 150MB (leaving only 500MB to write to), and copies data at approximately 300K/sec (2x speed). Two CD-R recordable discs and one CD-RW rewritable disc are included.

But the read speed of Philips' drive is pathetic at 6x, and Gateway recognizes this. Instead of adding an additional CD-ROM drive, it's opted for a full DVD hardware subsystem utilizing Toshiba's second-generation DVD drive and STB's Mpact DVD hardware decoder, making DVD movie watching a hassle-free, though mediocre, reality. The artifacting and jagged lines wouldn't be so apparent pumped out to a TV, that is *if* the G6-450 offered TV connectivity. With no TV-out plugs on either the DVD decoder or the Velocity 128 it's connected to, you'll never know.

STB's Velocity 128 handles 2D video competently and is backed by the Blackmagic 3D Voodoo²-based accelerator, which pumped out some excellent Direct3D scores. It's a shame Gateway didn't incorporate a better soundcard, using either Aureal3D (A3D) or Creative Labs' new Sound Blaster Live! technology. Boston Acoustics' BA635 speaker system includes two mini satellite speakers that sound excellent, delivering good mid-range sound. The subwoofer lacks deep lows and punch, although the crossover between the two is seamless.

With some minor revisions, Gateway would have a winner with the G6-450. This is a reasonably priced system offering solid components for starting a power user's home-brewed creation or fulfilling the needs of a computer neophyte.

—Sean Cleveland

UNDER THE HOOD

THE BRAINS	
CPU	Intel 450MHz Pentium II
L2 Cache	512K SBRAM internal
RAM	64MB SDRAM 100MHz
Motherboard	Intel SE440BX ATX
Drive Bays	One AGP, four PCI, two ISA, one shared PCI/ISA
I/O Ports	Two USB, two serial, one parallel, and one gameport
DISPLAY	
Video	STB Velocity 128 (Riva 128 ZX) with 8MB of 128-bit SGRAM, STB Blackmagic 3D Voodoo² with 12MB of EDO DRAM
Monitor	Gateway 2000 VX900 (Hitachi) 19-inch with 0.26mm dot pitch and digital controls
Res/Refresh	1600x1200/60Hz at 32-bit color
STORAGE	
Hard Drive	IBM DeskStar 14.4GB 7,200RPM Ultra DMA IDE
CD/DVD	Toshiba SD-M1102 2x DVD-ROM (24x CD-ROM) with 256K buffer, Phillips CDD3610 ATAPI CD-R/RW 2x write/6x read with 1MB buffer
Removable	None
Fax/Modem	3Com 56K V.90 internal voice
SOUND	
Sound	Creative Labs Sound Blaster AudioPCI 64V (on motherboard)
Speakers	Boston Acoustics BA635 Compact Stereo Sound System with two satellites & subwoofer
OTHERS	
Multifunction keyboard, Microsoft Intellimouse, 200-watt power supply, Mpact 2 3DVD hardware playback card	
THE BUNDLE	
Microsoft Titles (Windows 98, Publisher 97, Bookshelf 98, VirtualGlobe, Streets 98, TripPlanner 98, Publisher 97, Home Essentials 98, Greetings Workshop, Encarta 98 Encyclopedia, Money 98, Age of Empires, Flight Simulator 98, Close Combat: A Bridge Too Far, Monster Truck Madness, Creative Writer 2, School Bus (Rainforest & Dinosaurs), 3D MovieMaker, Plus for Kids) I DreamWorks Interactive (Dilbert's Desktop Games, The Neverhood, Goosebumps, Interactive Chaos Island) I Netscape Navigator 4.0 I Mpact Mediaware I Quicken Basic 98 I Warner Music Group Does DVD Volume 2 I Jack Nicklaus 4 DVD	

BOOT 0:54 DOWN 0:04

REAL WORLD BENCHMARKING

CPU/MOTHERBOARD bootMark		208
WINDOWS APPS SYSmark 98	official score	177
HARD DRIVE HD Tach	MB/sec	12.1
CD-ROM CD Tach98	drive rating	15.6x
3D RENDERING Newtek Inspire3D	sec	489
DESKTOP PUBLISHING Adobe Photoshop 5.0	sec	100
DIRECT3D ForsakenMark	fps	71.0
OPENGL Quake2 v3.15	fps	55.9

MAXIMUM PC VERDICT

Price $3,229
Company Gateway
Phone 800.846.2000
URL www.gateway.com

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EXPANSION NOTES

Gateway makes expandability a viable option. With two free PCI slots, a free 5.25-inch drive bay, and a free 3.5-inch bay for a Zip or HiFD drive, the G6-450 is a machine to grow into.

EXPANSION MAP

AGP	2D videocard
PCI	Hardware DVD card
PCI	3D videocard
PCI	Free
PCI/ISA	Free
ISA	56K modem

IROS

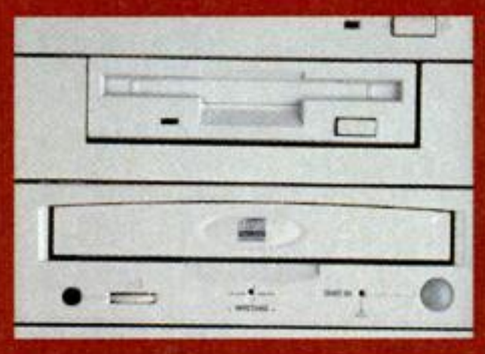
00	System timer	08	System clock
01	Keyboard	09	PCI to USB
02	IRQ controller	10	Media processor
03	Modem	11	Sound/2D video
04	COM1 port	12	PS2 Mouse
05	Open	13	Num data proc
06	Floppy port	14	Primary IDE
07	LPT1 printer port	15	Secondary IDE

DMAS

01	Soundcard	05	Open
02	Floppy controller	06	Open
03	Open	07	Open
04	DMA controller		

Smokestack Lightning This hood pulls the heat off Intel's Pentium II 450MHz furnace—the massive heatsink is cool to the touch.

Ultra DMA Powered Gateway couldn't have chosen a finer hard drive than IBM's DeskStar 14.4GB speed demon. It delivers data at up to 13MB/sec and an average seek of 11.7ms.



Who needs a Zip drive? With the CD-R/RW drive, you can share data with the world. Just make sure any discs you hand out are going to people with multiread CD-ROM drives.

Room to Grow This logo defines bump mapping. Dissing the old printed text for this more elegant logo may not make the machine run any better, but it certainly gives it an air of Gateway pride.

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Philips Nino 312

Storm clouds on the PDA horizon

The heftiest of the Windows CE "palm-size PCs" so far, the Nino has the potential to rock the PalmPilot world, but is ultimately hampered by a clumsily implemented user interface and by exclusive use of Microsoft products.

THE SPECS

PROCESSOR
MIPS R3000 75MHz

SCREEN RESOLUTION
320x240, 4-level gray

RAM
8MB

I/O
IrDA port, docking port

DIMENSIONS
5.25x3.41x.75; weight, 7.8 oz without batteries

INCLUDED ACCESSORIES
Dock, Nickel Metal Hydride rechargeable batteries

OTHER ACCESSORIES
Car adapter, modem

OTHER
Recording and voice recognition, CF-2 card slot

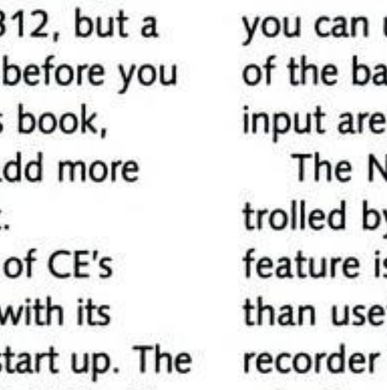
BUNDLE
Microsoft Schedule+ 7.0a. | CE Services 2.1 | Expedia Pocket Streets

PLUSES
- Easy to add a 16MB CF-2
- Internet connectivity out of the box
- Buttons along rubber-coated side allow one-handed use
- Better software bundle than PalmPilot
- Familiar Windows interface

MINUSES
- Windows interface clumsy on tiny vertical screen
- Must buy into the Microsoft empire
- Large for a pocket device
- Battery hog

CE shares some traits with its big-brother operating systems. When your palm device inexplicably slows down or acts odd, the manual says to "reset your device to restore normal behavior." In other words, reboot. Part of the problem is that CE doesn't terminate applications when you're done using them—you must manually kill them. After a day of use, open applications will consume at least 3MB as programs stack up. In testing, our Nino gave us an "out of memory" error with plenty of RAM available. And don't let the 8MB tag fool you. You'll have to set aside almost half of it for applications. We stored 600 records without making a dent in storage RAM in the 8MB model 312, but a 4MB version will top out before you hit the F's in your address book, although you can easily add more RAM through a CF-2 slot.

The hand-held version of CE's bangs you over the head with its clumsiness at application start up. The ubiquitous Windows 9X/NT "Start" metaphor just doesn't work on a tiny vertical screen. But while Microsoft's dominance in OSes can leave a bad taste in your mouth, its applications have always been creamy. *Pocket Outlook* does calendaring right and takes full advantage of the grayscale screen. The month view shows your day at a glance, while the Active Desktop summarizes your upcoming appointments and to-do tasks.



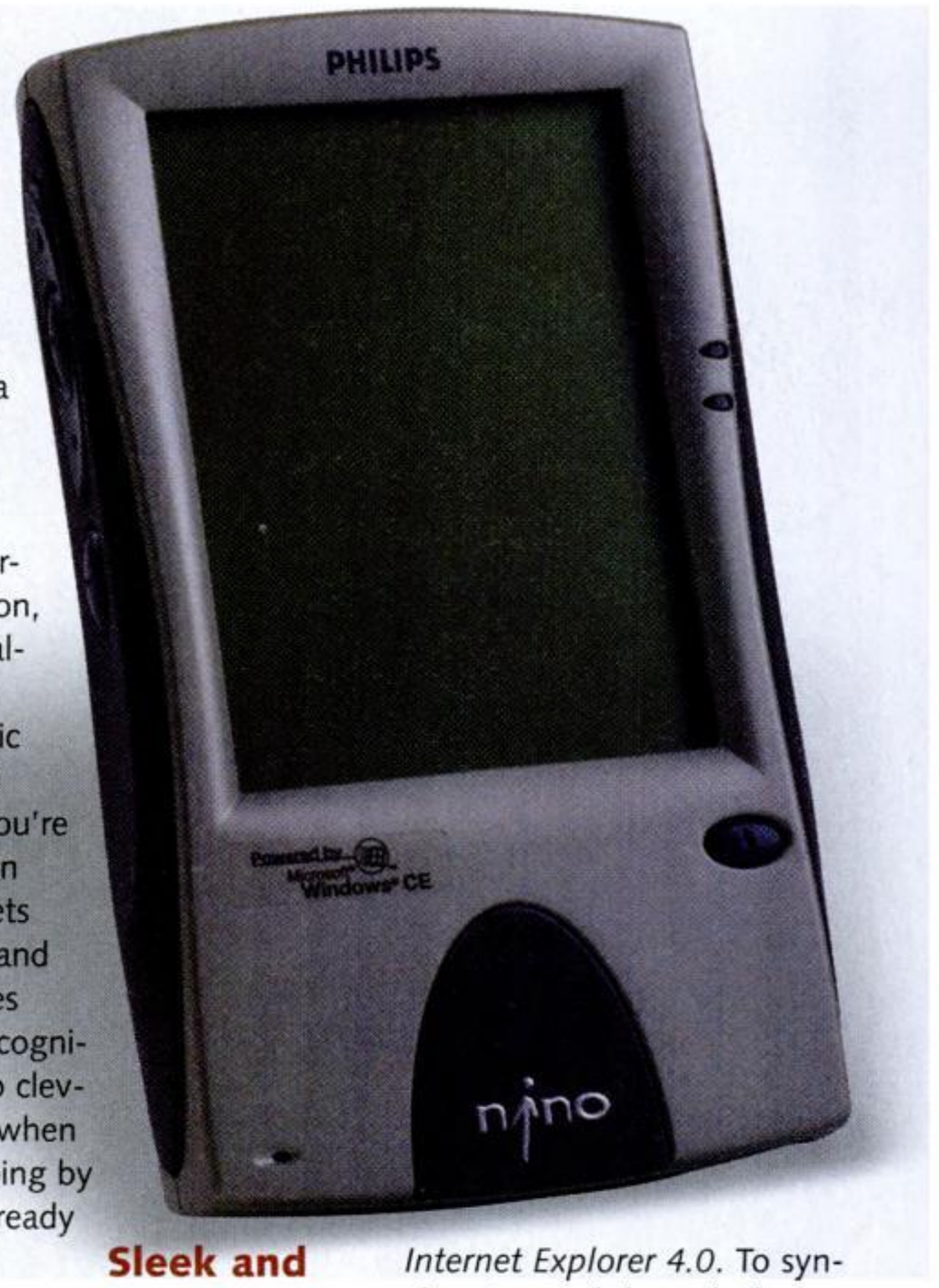
Scroll and action buttons on the rubberized grips let you access a majority of the Nino's functions with one hand.

Graphically, CE makes a PalmPilot look sparse and dull. But not all is good. Some input screens are frustratingly cluttered with buttons and doo-dads.

Philips serves up a generous portion of input options. CIC's excellent *Jot*, a *Graffiti*-like character-recognition application, requires fewer specialized characters than Palm's software. Tegic Communications' T9 guesses the words you're tapping, an on-screen standard keyboard lets you hunt and peck, and *smARTwriter* provides another character-recognition method. CE also cleverly suggests words when you're writing or typing by using data you've already entered. The Nino's virtual scratch pad means you can use nearly 100% of the backlit screen and input area.

The Nino can be controlled by voice, but the feature is more gee-whiz than useful. The voice recorder is another matter. Clicking a button and dictating a quick memo is great. But the features come at the price of power. The Nino inhaled several sets of AA batteries in just a week of testing. Philips says to expect about 10 to 12 hours of time on a set of batteries and supplies rechargeables with the 312 model.

Some users will be troubled by the almost exclusive use of Microsoft products. To download web channels for offline browsing, you need *Internet Explorer 4.0*. To synchronize mail through the docking station, you'll have to use *Outlook Express*, which requires *Internet Explorer 4.0*. Get the point? If your office or home is wired into Eudora/Netscape you're out of luck.



Sleek and functional hardware can't save shoehorned software.

Is the Nino good enough to make you sell your PalmPilot? No. More importantly, it remains to be seen whether widespread developer support for the Nino and other CE devices will materialize. Hard-core PalmPilot owners shouldn't feel threatened at this point, but 3Com should take notice that a storm front is developing.

—Gordon Ung

MAXIMUM PC VERDICT

Price $459 for 8MB 312 model; $399 for 4MB 301 model
Company Philips Electronics
Phone 800.326.6586
URL www.nino.philips.com

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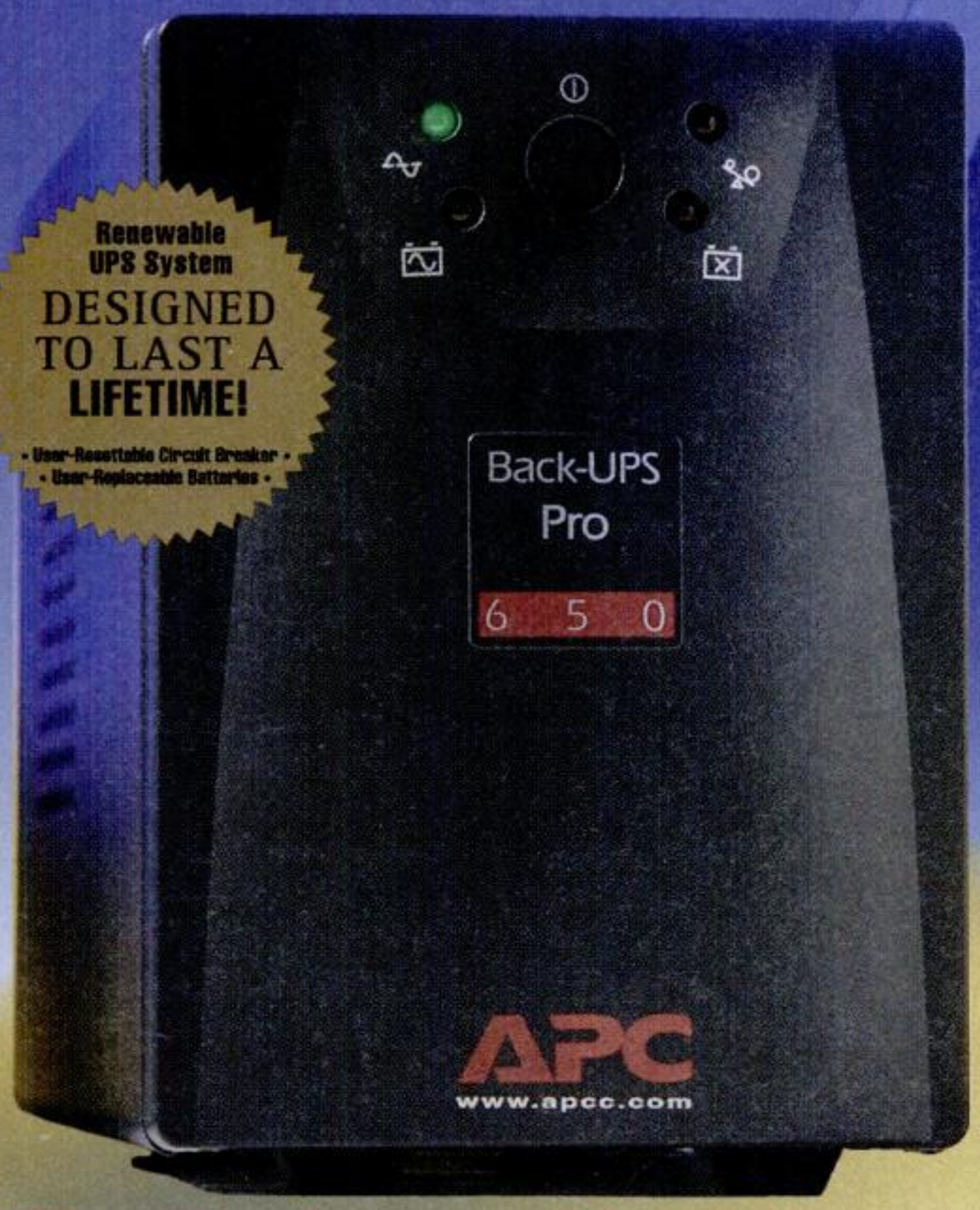

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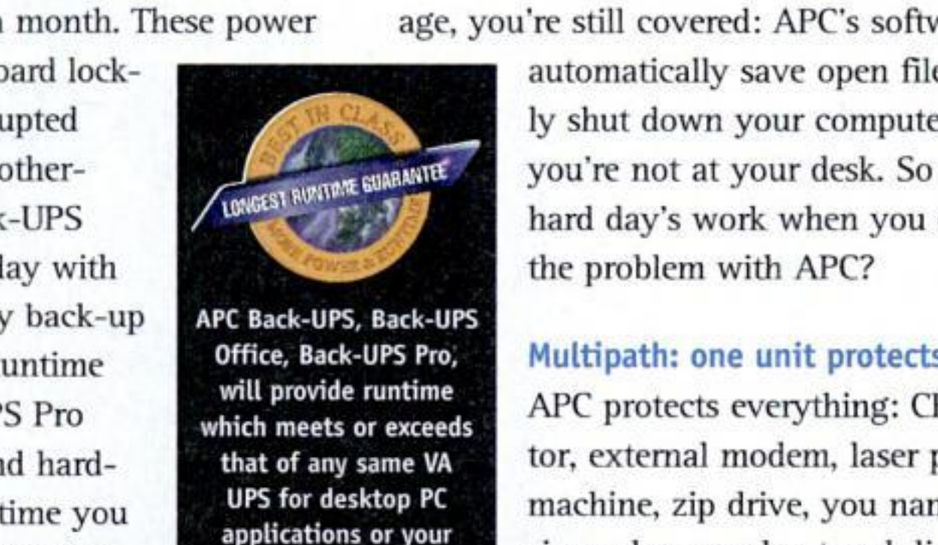

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Biography ▶

Phil Lacefield Jr. comes to the *Maximum PC* fold fresh from the wilds of Dayton, Ohio, and the *Midwest PC Review*. A huge fan of Babylon 5 and the color black, Phil helped open the only Internet café in town and quickly rose in the ranks of local *Quake* CTF badasses. For a living, Phil runs a busy used computer store and a local ISP, co-hosts a call-in radio show on computers, maintains **www.lacefield.com**, and helps create sci-fi board games. Vaguely familiar with the concept of sleep as "that time when you close your eyes and sit still for a really long time," Phil has been gaming since the VIC-20 and would really like to have a serial port permanently installed in the back of his head in order to communicate directly with his beloved Palm Pilot. Currently, Phil is hip-deep in his latest project, building a fresh-water aquarium inside the gutted shell of his trusty old Mac Classic SE. Any comments, questions or bomb threats should be sent to **phil@lacefield.com**.

Alan Kennedy is Technical Director/Senior Animator at Soho Post & Graphics, a Toronto-based postproduction company. Alan's worked in the television industry since 1979 and has been at Soho Post for the last eleven years. His primary focus is to ensure that every project meets the highest creative and technical standards, and to ensure that the facility remains at the forefront when it comes to software and hardware technology. Alan has created animation and supervised FX sequences for numerous commercial and broadcast clients. Some recent clients include CTV Sports, CBC, Trio, Sega and Hockey Night in Canada. Alan is also a part-time instructor at Centennial College and the University of Toronto. You can reach him at **alan@sohopost.com**.

Shel Kimen wishes she was a rock star, but she's not, yet. Instead she's an information architect and technology journalist in New York City. She's been online longer than is reasonably healthy for a woman of 27, and has the poor eyesight and occupational therapy bills to prove it. When she's not hacking code or "conceptualizing space," she's often been seen pulling the wings off mosquitoes and plotting social revolutions. Shhh.

Rick Stevens is an independent multimedia developer and principle of Wordcrafted Media in San Francisco, CA. His real-world experiences in 24 years of selling and procurement at the retail and wholesale level spawned a conviction that American industry needs the fruits of the digital revolution to survive in a global economy. A no-nonsense veteran of industrial selling, he quickly separates the chaff from the wheat where PC hardware and software are concerned. His firm, Wordcrafted Media, provides solid PC-based marketing, training, and communications presentations to propel business clients into the global village economy of the 21st century. Rick can be reached by e-mail at **rstev@wrdcrft.com**. Wordcrafted Media's web site is located at **www.wrdcrft.com**.

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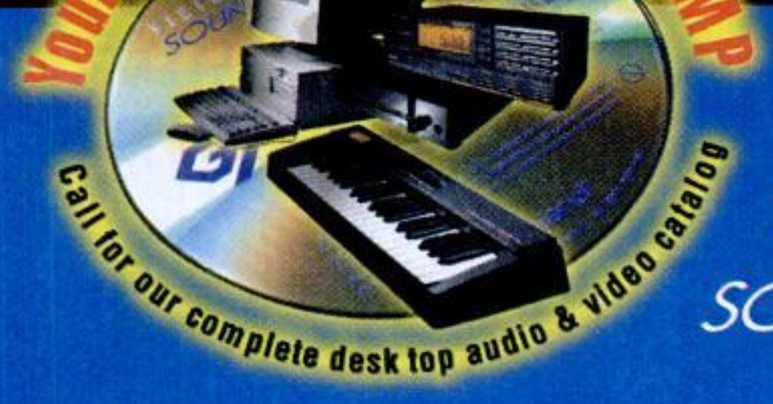

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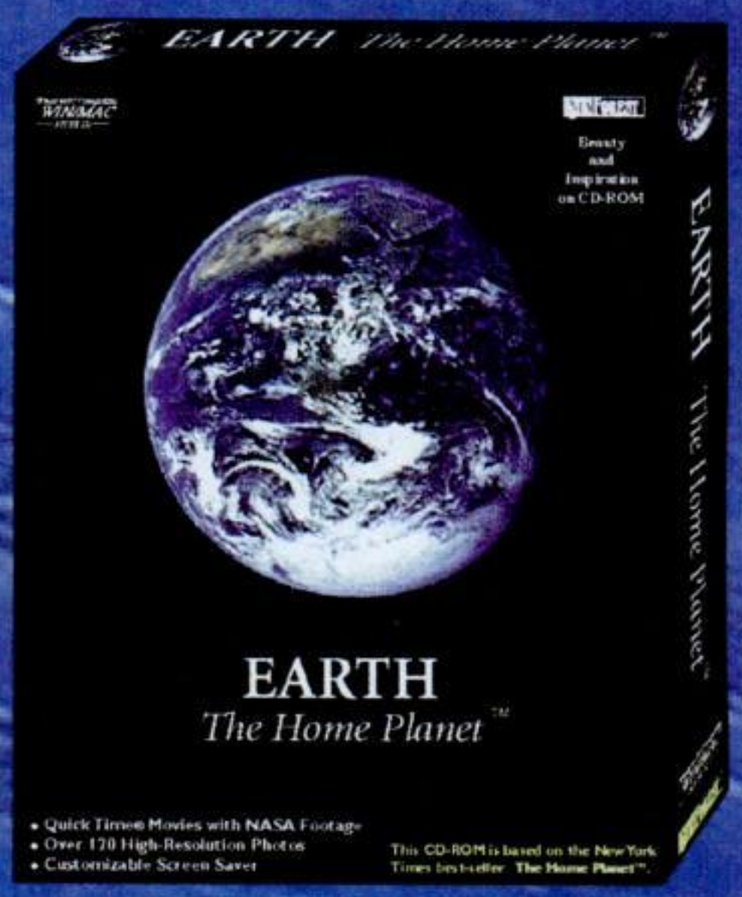

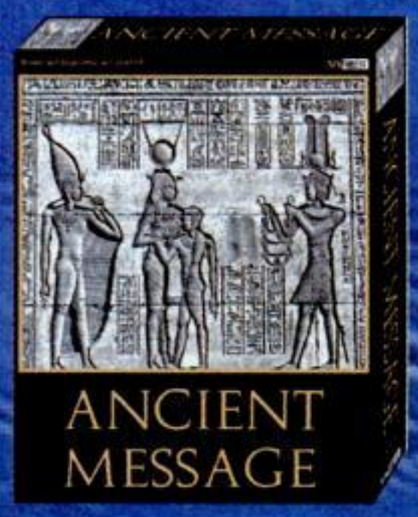

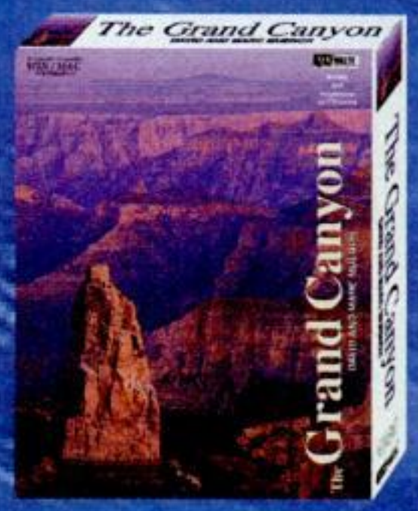

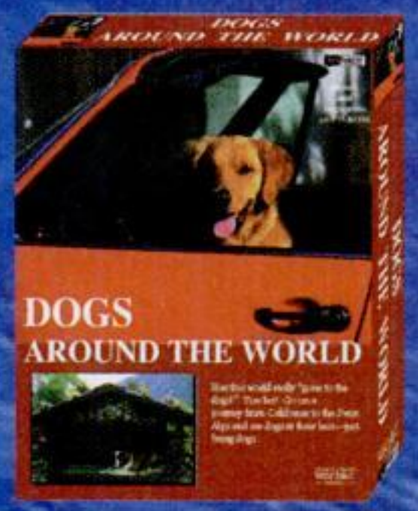

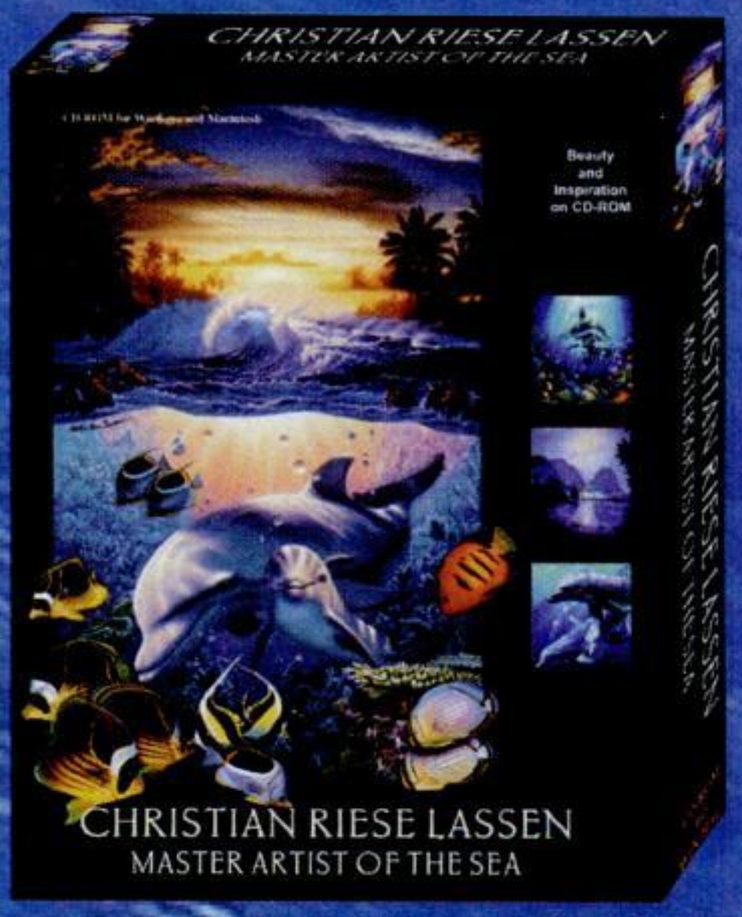

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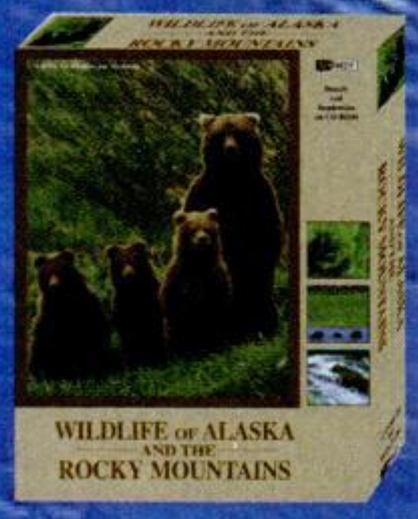

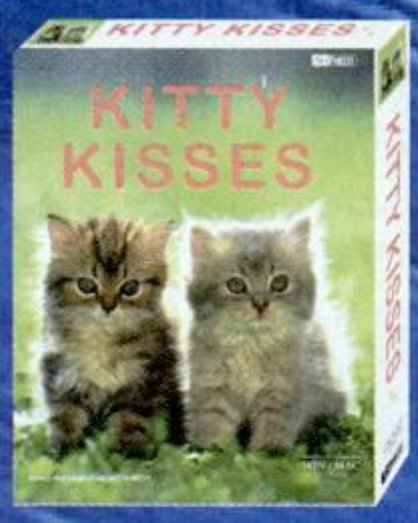

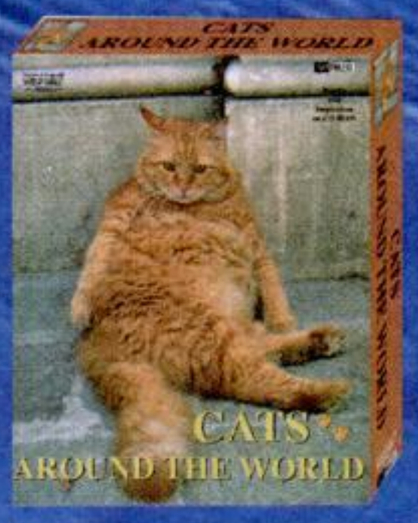

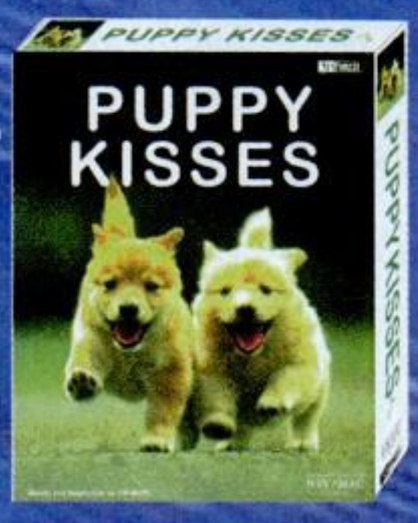

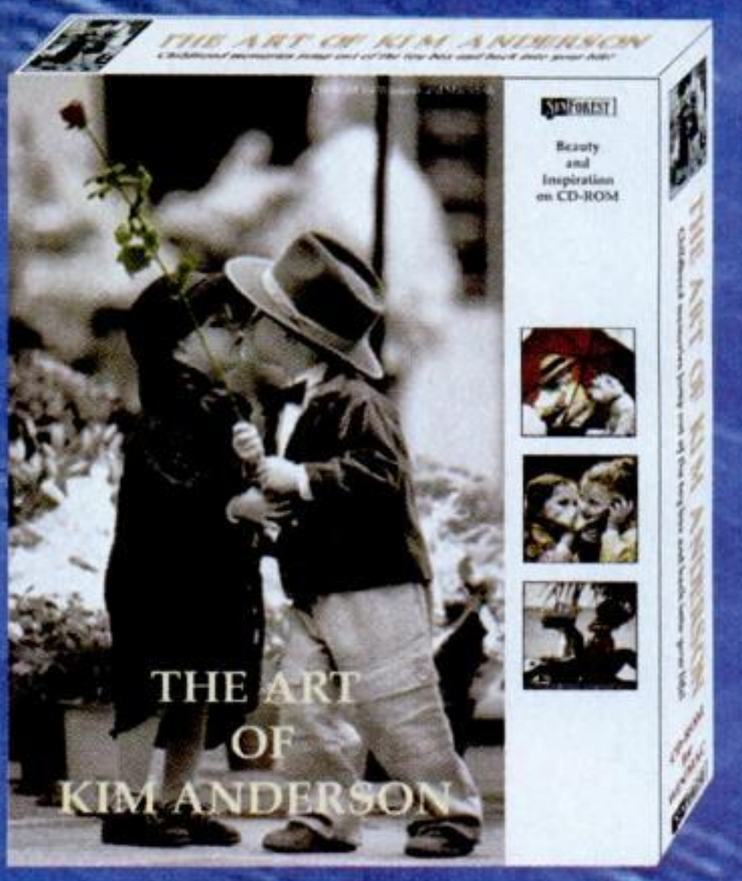

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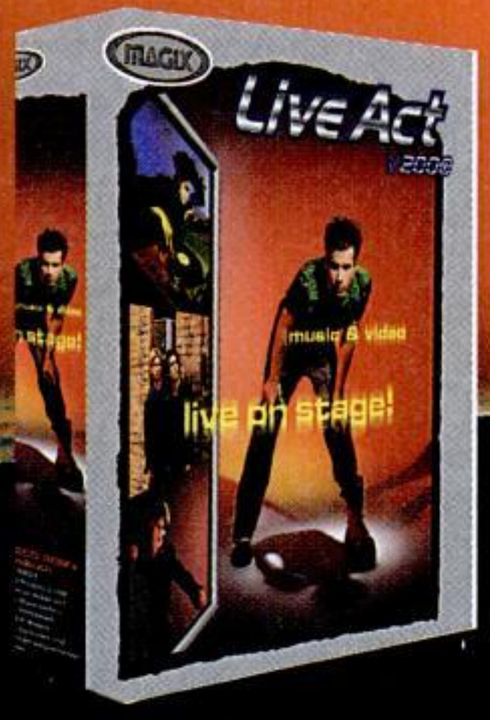

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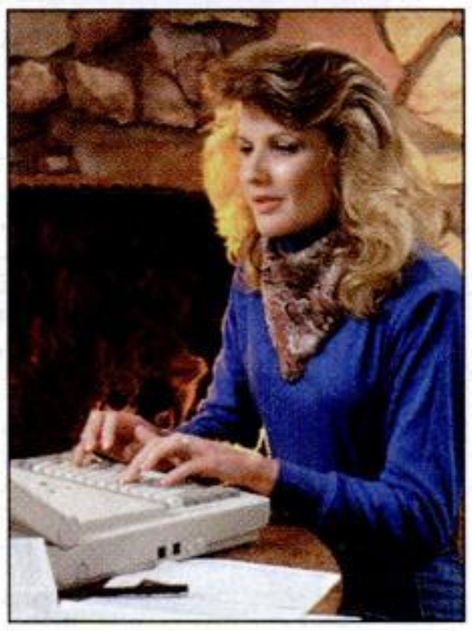

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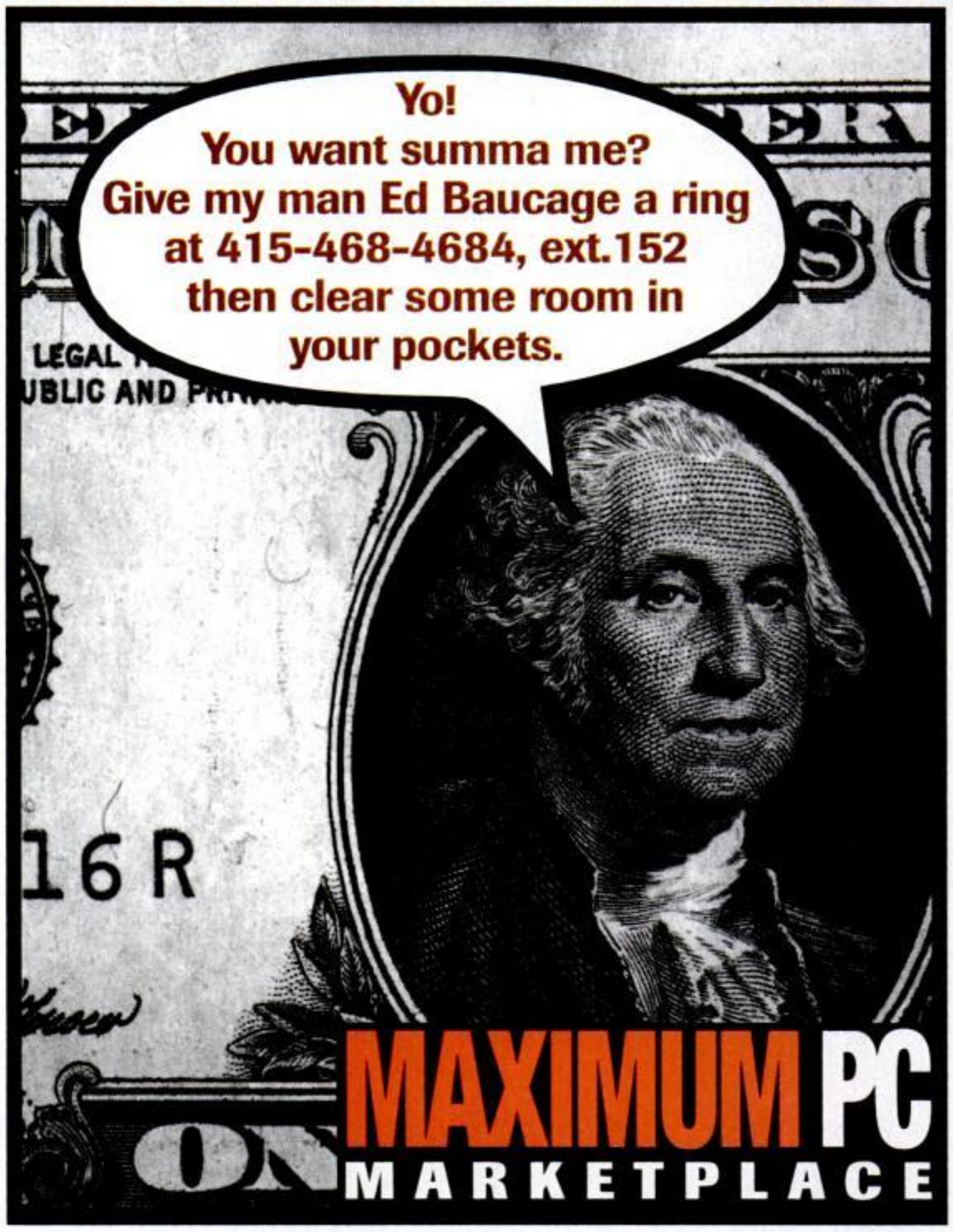

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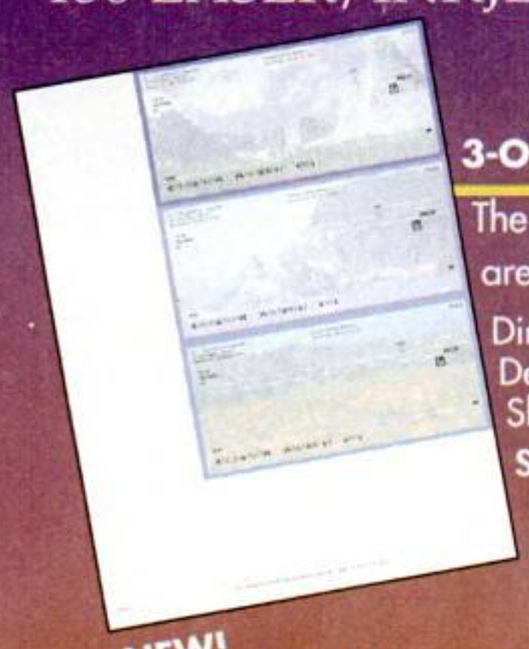

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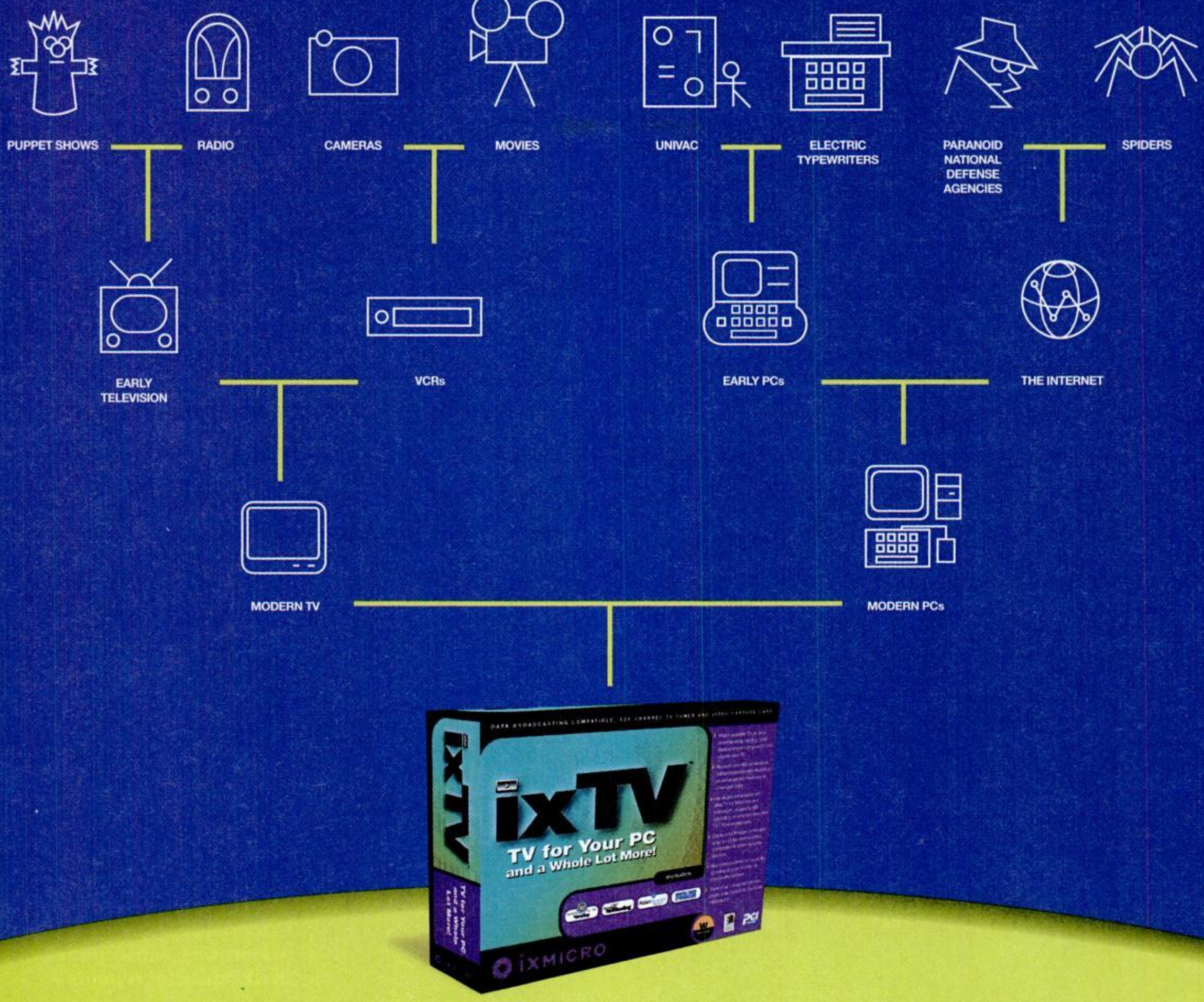

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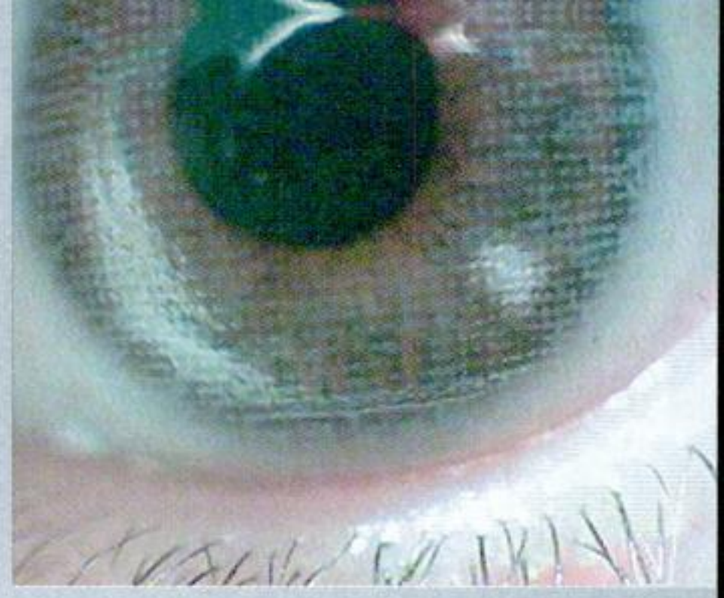

Tech Terms Revealed ▶

Technical terms found throughout MAXIMUM PC are underlined and in blue. Hyperlink back to here for revelation and further explanation. The extended Terminator is also found online at **www.maximumpcmag.com**.

A

accelerates Instead of processing sound on the host CPU, sound is processed locally on the soundcard, freeing up CPU cycles.

Accelerated Graphics Port AGP is an expansion bus developed by Intel specifically for the videocard subsystem. It operates independent of the PCI bus and normally runs at 66MHz (i.e., 1x). Whenever you see multipliers attached to AGP, such as 2x or 4x, they are referring to how much faster the bus will run—2x means 66MHz x 2, or 133MHz.

AC-3 Also Dolby Digital 5.1. AC-3 is a method of encoding sound to five discrete or separate channels. Mainly—front left and right, front center, and rear left and right.

ADSL Asymmetric Digital Subscriber Line. A modem technology that simultaneously delivers data, video, and voice over existing copper telephone lines. It receives data at rates from 1.5Mbps to 9Mbps, and sends data upstream from 16Kbps to 640Kbps. It requires a special ADSL modem.

AGP see Accelerated Graphics Port

anisotropic filtering Conventional texture filtering techniques do not compensate for anisotropy—the elongation of the screen pixel when it is mapped into texture space. This results in either blurring or aliasing, depending on the choice of texture level-of-detail. To achieve sharp textures, a card can use anisotropic filtering, a process that involves an elliptical kernel whose shape and orientation depends on the projection of the destination pixel onto the texture map.

artifact Graphical flaw caused by compression technology. Often manifested as blotchiness in what should be a solid color.

ATAPI (ATA Packet Interface) Commands supported through the ATA-2 interface for peripherals other than hard drives, such as CD-ROM, DVD-ROM, and tape drives.

A3D See Aureal3D

Aureal3D Proprietary API for handling 3D positional sound and Doppler effects on a PC. Using algorithms developed for NASA, A3D simulates 3D positional sounds on two speakers. A3D will support four or more speakers, but is optimized for two.

B

beta silicon Electronics equipment goes through several stages of development: alpha, beta, and final. Alpha refers to first-run hardware—it is extremely buggy and prone to crashes. The purpose of alpha silicon is to test whether the design works and to shake out any problems or bottlenecks within the architecture. Beta is the second stage, and this is where most of the major bugs are ironed out. Beta silicon will more likely resemble the final product. From here, once the product goes through final quality assurance, it's deemed a "final" product and is packaged and shipped into your hot lil' hands.

bezier control-point deformation In drawing applications, a curved line defined by at least three adjustable points. The shape of the curve can be altered by tweaking the handles extending from each point.

blit Bit Level Transfer. The act of drawing a pixel on screen in a 2D application. Examples of this include drawing sprites in a game or manipulating graphics in a Photoshop application.

boning techniques The placement of control vertices called "bones" within a mesh object. A related set of bones forms a hierarchy that, when associated with the mesh, defines mesh movement in animation.

Boolean Branch of mathematics addressing relationships between entities. In 3D modeling they are: Union (the combination of two sets), Intersection (the overlapping of two sets), and Subtraction (the part of one set remaining after an intersecting set is removed).

broadband A type of data transmission that can accommodate multiple channels at once over a single medium (such as wire). Cable TV, for example, uses broadband transmission to send multiple channels over a single cable.

buffer underrun Occurs when the system cannot keep up a steady data stream to the CD recording software. The CD recorder itself has a buffer that is constantly filled with data in the event of a system slowdown or interruption. If the buffer is emptied before the system can recover, a buffer underrun occurs. The disc that was being burned is no longer usable and is further referred to as a "Gold Coaster."

bump-mapping A visual trick that attempts to simulate a texture's roughness or smoothness, depending on how the texture reflects lights. In 3D, this is usually accomplished by laying two textures onto a polygon-a base texture for the graphics, and a second displacement texture that is mapped on the object. This second texture is used to determine how "rough" the surface will appear.

C

Cathode Ray Tube Traditional monitors contain CRTs, which work by passing an electron beam through a screen filter and onto to a field of phosphorous dots, which light up and define the image you see.

CAV see Constant Angular Velocity

CD-DA (Compact Disc-Digital Audio) Music CDs, developed by Sony and Philips in 1982.

CD-R see Compact Disc-Recordable

CDRFS see Compact Disc-Recordable File System

CD-RW See Compact Disc-Rewritable

CF-2 Compact Flash 2. A postage stamp-sized industry-standard memory module.

CISC (pronounced sisk) Complex Instruction Set Computer. A variety of processor that uses complex assembly-language level instructions to perform base-level operations. The Intel 80x86 series architecture is based on CISC technology. Also see RISC.

CLV see Constant Linear Velocity

Compact Disc-Recordable A write-once technology that uses gold recordable discs. Standard 74min CD-R media can hold up to 650MB of data.

Compact Disc-Recordable File System A file system developed specifically for CD-R by Sony. It utilizes packet writing and requires a reader driver that can be imbedded into each disc written that allows other computers to read it. The disc requires a "link area" between packets on the disc that links packets together. This creates overhead that reduces the size of a typical 74min disc from 650MB to 520MB. After recording a session, you are required to "freeze" the disc, enabling it to be read on a CD-ROM drive. Each freeze performed consumes an additional 13.5MB of space.

Compact Disc-Rewritable A rewritable technology whose media can be written to and erased approximately 1,000 times before failure. Standard 74min CD-RW media can hold up to 500MB when formatted for fixed-length packet writing.

compression A way to shrink file size, to reduce in size or volume. Compression is important to make large graphics take up less bandwidth.

Constant Angular Velocity CAV CD-ROM drives spin the disc at a constant speed, so the data rate increases as the pickup moves to the outer edges of the disc. Constant motor speed also eliminates the need for settling of the optical pickup after seeking data, resulting in an improved access rate. CAV-based drives are simpler to design and produce because the motor doesn't need to change speed.

Constant Linear Velocity CLV drives vary the speed the disc is spinning at so that the data rate of the drive is constant. The drive rotates the disc faster when reading the inside tracks and slower when reading the outside tracks as more data is pumped through the head. This is to ensure a constant data rate regardless of where on the disc it's being accessed. CLV-based drives generally encounter latency at high-speeds when the rotational speed needs to be changed.

CRT see Cathode Ray Tube

D

dedicated frame buffer Video processors need a specific chunk of memory dedicated for frame-buffer/Z-buffer data storage. Often used when describing a split-memory architecture, where the 3D architecture needs two independent chunks of memory-one for the frame-buffer, the other for texture storage. 3Dfx's Voodoo/Voodoo^2 and Intel's i740 are examples of cards requiring a dedicated frame buffer. All other cards use a unified memory architecture.

Digital Video Disc-Read Only Memory The next-generation CD-ROM standard. A single-sided DVD-ROM media can hold up to 4.7MB, with double-sided media holding twice that.

digital zoomed video A standard for sending high-bandwidth video directly to the display adapter and bypassing the CPU and system bus.

Disc-at-Once A method of writing CDs where one or more tracks are written in a single operation without turning off the laser.

DMA Direct Memory Access. A method used to speed up data transfers between peripherals (such as hard drives) and RAM. DMA avoids the delays imposed by the CPU's data-flow regulation, accessing RAM directly.

dual-Scan Line Interleave see Scan Line Interleave

dual 32-bit graphics pipeline Refers to the number of processors, and the data bit width, of a graphics processor. See single-rendering cycle for more information.

DVD Hardware Decoder A physical card inserted into a PCI slot whose sole purpose is to decode MPEG-2 video streamed to it via a DVD drive, taking the pressure off the CPU.

DVD-ROM see Digital Video Disc-Read Only Memory.

E

EDO DRAM Extended Data Out Dynamic Random Access Memory. A low-cost memory that loses data if it's not recharged regularly quickly (a process known as refreshing). This refresh process is what makes DRAM slower when compared to memory that doesn't require this refresh, such as SRAM.

engine The underlying programming code that drives a game.

environment mapping A texture's ability to accurately map a reflection of its surrounding environment on itself. This is useful for giving textures a highly reflective appearance, such as simulating chrome.

F

fixed-length packets Packets of data are written to a CD-RW disc with a fixed length of 32K (as required by the UDF standard). CD-RW drives that support these packets support random erase, which is the ability to erase a single file at a time, freeing up space that can be used like a hard drive or floppy disc.

floating-point A computer operation that uses a "floating" decimal point to quickly calculate a large set of numbers in one fell swoop. 3D games, Photoshop filters, and scientific simulation programs all use floating-point operations. For example, a 3D game uses floating-point operations to rapidly calculate the numerous changing polygons in its complex 3D environment.

FM synth Frequency Modulation Synthesis. A music simulation technique that approximates the sounds of real instruments by bending raw electronic wave forms. Wavetable synthesis, which uses samples of real instruments, is preferred.

fogging The ability for a videocard to correctly simulate fog in an environment, and to render objects that enter that fog correctly. This creates a simulation of distance and atmosphere—the farther the object or terrain is, the higher likelihood it will be enveloped in fog.

frame buffer The memory on a graphics card that is used to hold data and pre-rendered frames when they are not being displayed on screen. When these frames are needed, they're converted by the RAMDAC and then displayed on screen.

full-screen, order-independent Usually used when describing anti-aliasing, this refers to the fact that a 3D accelerator can apply an anti-alias filter on a full-screen picture (as opposed to just filtering the edge of a diagonal line, a.k.a. edge anti-aliasing). Order-independent means the anti-aliasing filter doesn't care in what order the pixels are being rendered in 3D space—it'll just anti-alias the whole lot of 'em.

G

GDI Graphics Device Interface. A part of the display subsystem within Windows that controls and maintains how graphics will be displayed on screen. This usually involves software drivers written for videocards interfacing with this GDI, and then the data transfers take place.

geometric distortion A visual flaw in which display content is bowed or out of proportion, for example, straight lines look curved, squares look rectangular, and perfect circles look like elongated ellipsoids.

Graffiti Not what you see all over Los Angeles or New York. It's a fairly easy-to-use character-recognition application where users memorize a few specific short-hand commands to enter alphanumeric data.

graphic An image file. Graphic is another word for "picture."

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H

hot flashes That warm, fruity feeling you get when you are introduced to software or hardware that you must have.

I

ICD Installable Client Driver.

IDE (Integrated Drive Electronics) The most popular hard drive interface, whose controller functions are built into the drive's circuitry. All motherboards today come standard with two IDE channels that can each control up to two devices. Hard drives connect to these interfaces via a 40-pin connector.

image map A web image with multiple associated links instead of just one. Image maps can be built as both "client side" (the browser supports the code to define where users can click) or "server side" (the Web server supports the code to define where users can click). All 3.0 browsers and up support client-side image maps, which is recommended.

integrated circuit The blanket term for all computer chips—CPUs, memory modules, core-logic chipsets, 3D accelerators, and even the chips run $10 calculators. All integrated circuits contain microscopic layers of circuit paths applied by photolithography.

interface burst speed The speed that data can be accessed from the drive's onboard read-ahead memory. This measures the speed of the drive and controller interface.

internal rendering Refers to the color-depth a 3D accelerator will render a scene at. Depending on the videocard, this may be 16-bit (64K colors), 24-bit (16 million colors) or 32-bit (16 million colors plus 8-bit alpha). The higher the internal-rendering bit depth, the more colorful the output.

interpolation A mathematical process used to estimate a value that lies between two known values.

ISDN Integrated Services Digital Network. An international digital telecommunications standard that accommodates voice, data, and signaling over digital telephone lines. Its two common twisted pairs of wires deliver two 64Kbps bearer signals and one 16Kbps data signal. The two bearer signals can be used simultaneously, one for voice and one for data, or you can use both lines for data for data rates of 128Kbps.

isoparm iso parameter. Subdivision of a NURBS.

J

Javascript Scripting language to extend the capabilities of HTML that both Netscape and Internet Explorer can read.

L

L2 cache A high-speed bridge between the CPU and main system memory. Because the CPU runs faster than the memory bus—say 400MHz versus 100MHz—cache becomes useful to temporarily store instructions and data, making sure the CPU has a steady supply of material to churn on while memory catches up.

lathing Modeling technique employing a two-dimensional outline of one half of a symmetrical shape, which is then spun around a 360 degree path to create a circular solid.

lattice A lattice is basically a box around a shape. Say you have a 9x9 lattice around a character. You have series of control points in the shape of a cube that you can then pull and animate. The result is that anything in the lattice box is affected. For example, you might use a lattice over a character's waist to twist it.

layers In image-editing tools, you can edit a "layer" of an image without effecting another "layer" of the image. For example, if you create a "background" layer, and then create a "text" layer, you can edit each layer separately.

lighting effects A process within a game where the brightening of specific pixels is done in an attempt to simulate light-source effects on different objects. The higher the color depth, the more realistic the lighting will appear, as more gradients from the original nonlit color to the fully lit color can be displayed.

local memory A videocard-specific term, this refers to the memory installed directly on the videocard and is directly interfaced to the videocard processor. This really close, or "local" memory, is used for texture storage, data/Z-buffer storage, and more. This is considered the fastest place to store videocard data and is the preferred place to store all your data.

M

Memphis beta The code name for the successor to Windows 95 before Microsoft took the plunge on the risqué Windows 98 name.

Metaballs Modeling and animation technique using spherical or elliptical 3D objects in groups with gravitational attraction for one another. The closer they move together, the more they meld into an amorphous mass with each object retaining its independence of movement. Perfect for modeling organic shapes.

MIPS Millions of Instructions Per Second. Some argue MIPS is a bad metric for performance and open to interpretation.

mip-mapping Technique used to generate scaled texture maps that involves creating sub-images sized for every inverse power of two: i.e. 1/4, 1/16, 1/32, etc. The process of creating a mip-map takes time, and larger textures will require longer.

mixed-mode A CD that includes both computer data and digital audio tracks. The data is written on Track #1 and the audio is contained in the subsequent tracks.

Multi-Link Protocols Point-to-Point Protocol that allows multiple connections to be bundled together dynamically or on-the-fly to increase bandwidth.

multiread CD-ROM and DVD-ROM drives adhering to this specification can read commercial CDs (both data and audio), gold CD-R discs, and rewritable CD-RW discs (with both fixed- or variable-packets).

multisession A method of adding data incrementally to a disc, allowing additional data to be added to a disc that was burned previously. The data is linked between each session and is seen as a single logical structure.

N

neophyte One who is new to the dark arts of computer usage. Training happens invisibly and mastery is a direct correlation between money spent on upgrades and the time it took to get them running.

NURBS Non-Uniform Rational B-Spline. A mathematical representation of a 3D object.

O

object In the context of a web element, an object is a self-contained and independently scalable graphic element created by editable vector lines and fills, as opposed to a fixed resolution image composed of static pixels.

OEM Original Equipment Manufacturer. Companies that take the raw components and make a final product for consumers to buy. It usually refers to the company that'll make the part you buy-for example, Diamond Multimedia and STB are OEMs who make videocards based on technology bought from chip makers.

128-bit memory interface Refers to how many simultaneous bits of memory can be accessed for data storage and retrieval—the bigger the number of bits, the wider the data channel, the more data that can be pushed in a given processing cycle.

OrangeBook Defines CD-Recordable (CD-R) discs with multisession capability.

OSR2.1 An update to the venerable Windows 95 that was released only on new machines. Stands for OEM Service Release.

P

packet writing A method of writing data onto a CD in small increments. This is very different from Track-at-Once and Disc-at-Once methods. The packets of data written are either variable or fixed length.

PCI Peripheral Component Interface. 32/64-bit expansion slot/bus interface (running at 33MHz, or half the system-bus speed, and occasionally at 66MHz) developed to help break the slow 8/16-bit Industry Standard Architecture (ISA) bus bottleneck, which ran at 8MHz. This faster bus allows faster data transfers, thus speeding up any input/output. Videocards, I/O cards, SCSI cards, and other high-speed devices benefit greatly from the PCI interface's faster speeds.

PC100 A stringent memory specification used in the current top-of-the-line x86 machines. It calls for such things as six-layer boards, basically higher quality, and separate traces for power.

per-pixel mip-mapping As opposed to per-polygon mip-mapping, this technique applies effects to the scaled textures of a 3D polygon model on a pixel-by-pixel basis, creating more natural results. An example would be a light ball traveling down a hall. With per-pixel mip-mapping, the light cast on the walls has a smooth gradient. With per-polygon, the vertices of the polygons define the effect.

perspective correct Correctly applying bitmap graphics (textures) onto a polygon that will appear in 3D space, regardless of position or perspective. Without perspective correction, textures shimmer and dance about the polygon, causing visual deformation and general unhappiness.

pitch shifting Taking a sound and shifting its frequency.

pixel any of the small bits of information that together constitute an image

pixelfx2 A term specific to 3Dfx Voodoo^2 cards, it refers to a solo graphics processor chip that handles frame buffer/Z-buffer duties. At least two texelfx2 chips are needed for it to work properly in a Voodoo^2 configuration.

photolithography A process used to transfer circuitry designs to the surface of silicon (in the case of an integrated circuit, such as a CPU) or glass (in the case of a flat-panel monitor's TFT assembly). First, a photomask, or stencil, of the circuitry layout is created. Next, the silicon or glass is coated with a light-sensitive film. Now light is shot through the photomask and onto the light-sensitive film, which reacts by hardening in the areas defined by the photomask's outline. Finally, the silicon or glass is exposed to either acid or hot ions, which etch away the unhardened areas.

polygon count The number of texture-mapped triangles (otherwise known as polygons) that make up an object or character.

R

radiosity A rendering technique, which computes the diffuse inter-reflection of light between all surfaces in an image. This technique provides soft, subtle ambient shading and reflection between objects with low reflectivity. It excels at interior architectural rendering.

RAMDAC Random Access Memory Digital to Analog Converter. The chip on a videocard that converts the bits of a digital image into an analog signal. It maintains the color palette and determines refresh rates. The faster the RAMDAC MHz, the higher the refresh rate your system can handle.

R&D Research and Development. The folks in R&D wear white lab coats and spend all day inventing nifty new technologies without any concern for marketing or budget over-runs.

random access time The time it takes to read data. It's calculated by recording the time it takes to read a single sector, as the drive cannot respond to a command until the sector is available.

random erase Allows you to use your CD-ReWritable (CD-RW) drive like a floppy drive. Copying is done using small fixed-length packets that when erased, are actually removed. This allows the space to be re-used.

raytracing A method of 3D rendering in which light beams are followed individually from their source to the illuminated object and back to the camera. The resulting shading and illumination give a highly realistic appearance and are necessary for rendering true refraction, reflection, and transparency.

Redbook A specification written by Philips & Sony for audio compact discs (CD-DA).

refresh rate The rate at which a monitor redraws the image on its screen; measured in hertz (Hz). Refresh rates below 75Hz (75 redraws per second) typically create a flickering effect, which causes eyestrain.

RISC Reduced Instruction Set Computer. A high-performance processor architecture that increases processor efficiency by consolidating processor instructions. Motorola processors are RISC-based. Also see CISC.

S

Scan Line Interleave SLI, a term used when two videocards work in tandem, with one videocard rendering the odd lines of a video output, while the other card renders the even lines. With the 3Dfx Voodoo^2, the slave 3D card will send its rendered output via a ribbon cable into the master videocard, where the combined output is then generated on screen by the master card. Having two videocards work as one raises overall rendering performance, and in the Voodoo^2's case, allows a higher rendering resolution to be obtained.

SCSI (Small Computer System Interface) (pronounced "Scuzzy") A standard high-speed parallel interface defined by the X3T9.2 committee of the American National Standards Institute (ANSI). It is an interface like IDE that allows up to seven peripheral devices to be linked to a single controller. It is perfectly suited for true multitasking environments such as Unix and Windows NT with its ability to manage large storage devices such as hard drives and access its devices concurrently. It comes standard on most Macintosh, but requires an expansion board, or host adapter, in most PCs.

SDRAM Synchronous Dynamic Random Access Memory. A faster type of memory that synchronizes with the CPU. Its architecture allows it to run fast enough to handle the 100MHz system bus.

SGRAM Synchronous Graphics Random Access Memory. A type of single-ported memory often used for videocards that synchronizes with the CPU and uses techniques to optimize graphics processing. Considered faster than its SDRAM cousin due to its ability to perform mask writes and block writes.

sector The smallest recordable unit on a CD. A disc contains [(75 sectors per second) x (60 seconds per minute) x (number of minutes on disc)] sectors. The amount of data contained in the sector depends on the physical format it is recorded in. You can fit 2K of data into a sector on a CD-ROM.

Shotgun Diamond's modem bonding technology that combines two 56K modems for speed comparable to ISDN upstream but is still limited by the downstream speeds of two 33.6 modems. Bonding is different from multilink in that both lines are kept throughout the connection.

single-rendering cycle Usually associated with 3D rendering. Think of pixel processing as being like a conveyer belt, where the pixel data goes down the pipeline and is given attributes along the way (such as color, level of transparency (alpha), positioning in the z-axis, lighting, and so forth). A single-rendering cycle is just such an operation, with the final output being sent to a rasterizer, where it is displayed on screen. Certain attributes, such as bump mapping, environmental reflections, or lighting, may require a second run through this pipeline before heading off into the rasterizer for display. This second run down the conveyer belt is time-consuming and processor-consuming. If a 3D accelerator has a second processor that applies that second attribute alongside all the other attributes during that first cycle, the pixel can be processed in a single-cycle, thus speeding up the process.

software-rendered world Generally an ugly primordial ooze gamers were forced to live in before the advent of true 3D accelerators.

SoundFont A proprietary downloadable sound bank used in Creative Labs' products.

SPD Serial Presence Detect. A tiny programmable module on newer memory that stores module attributes. The information

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can be used by the motherboard to configure RAM timings.

S/PDIF Sony/Philips Digital Interface. A standard interface for sending digital audio data. Soundcards with S/PDIF jacks let you use your computer as a mini recording studio.

stencil buffer A small chunk of closely coupled RAM used for storing data that will be quickly compared to incoming data and changed as needed. A stencil buffer could be used to hold data for simulating realtime changes in a chunk of a scene, such as a mirror or shadows. Any changes can be quickly be changed and the output can accurately reflect these changes.

T

test beds A lab term referring to the control machines on which the technicians carry out their benchmarking and evaluations. Also refers to the sleeping platform where you evaluate the teachings of the Kama Sutra.

texel Short for TEXture ELement. Refers to the individual pixel that makes up a bitmapped graphic that'll be used as a texture when it's applied on a polygon.

texelfx2 A term specific to 3Dfx Voodoo^2 cards, it refers to two graphics processor chips that handle texture storage and processing duties. At least one pixelfx2 chip is needed for it to work properly in a Voodoo^2 configuration. Since Voodoo^2 has two of these texelfx2 chips working in parallel, this is considered a dual graphics pipeline capable of performing multi-texturing in a single-render cycle.

texture compression The ability to shrink texture data down from a larger size down to a smaller size by replacing certain types of data (determined by the compressor) deemed redundant and replacing it with an approximation that will be used in the lower-sized palette. This often results in lower-colored textures and could also cause some visual artifacts to be introduced, resulting in a dithered effect.

texture storage Refers to a medium where texture data (bitmap graphics that will be applied onto polygons) is stored. Texture storage can occur in (from fastest to slowest) local videocard memory, system memory, or on the hard drive.

TFT Thin Film Transistor; the essential component in any modern LCD notebook or flat-panel display. See page 70 for the full story on TFTs.

1394 Also known as FireWire in the Macintosh market. A high-speed bus protocol that transfers data at up to 400Mbits per second. 1394 is a great interface for digital video peripherals and may someday be used for high-speed modems.

track-at-once A method of writing CDs where the laser is stopped after every track (data or audio) has been written. This creates a gap between each two-to-three-secondaudio track.

trilinear filtering Taking two mip-maps closest to the texture size in question, applying a bilinear filter to it, then taking that result, and applying yet another filter, with that result being used as the texture. This is considered more accurate that bilinear filtering and results in smoother transitions between mip-maps.

24-bit precision Refers to the number of bits a process, such as Z-buffer calculations and internal rendering, will be accurate. The higher the number of bits, the more accurate the calculations will be. This will result in the lower likelihood of graphics glitches appearing on screen. An inaccurate Z-buffer calculation will result in dropped triangles or pixels, and will generally look yucky. See internal rendering.

U

UDF (Universal Disk Format) A new file system used for CD and DVD rewritable technology although compatibility with ISO-9660 for both reading and writing is ensured. UDF is a file system for optical media developed by the Optical Storage Technology Association (OSTA). It overcomes the small partition sizes of ISO-9660 and can be read and written to on all the major operating systems. Full support for Unicode is included, allowing for all special characters and multilanguage applications. This means that a disc written on a Macintosh will finally be readable in a Windows machine. Long filename support is also supported with up to 255 ASCII characters or 127 Unicode characters. UDF also gets rid of the directory depth limitations of the older ISO-9660 technology and utilizes space far more efficiently.

unified memory buffer A videocard-specific term, this refers to the video processor's ability to use the local video memory for both frame-buffer and texture storage duties simultaneously. The local video-memory usage is controlled by the videocard architecture, with the frame/Z-buffer getting higher priority over texture storage. If there is not enough memory left after the frame/Z-buffer is configured, then the videocard chip (if it's an AGP 1x/2x execute part) will use your system's memory for texture storage. Otherwise, the videocard gets the texture information from your hard drive, which is then sent into your local memory, which is then sent into the rendering pipeline for processing. This last process slows down 3D rendering considerably.

V

variable-length packets Packets of data are written to a CD-R or CD-RW disc with a variable length as their size varies with the size of the data being written. Variable-length packets are used primarily on CD-R discs, as it's not necessary to track and allocate free space when files are removed. This overhead makes it impossible to free up space on CD-RW drives. Files that are erased are made invisible, but the space is not actually freed up.

vector Vector graphics are static graphics, animations, and fonts created as mathematical descriptions, consisting of a collection of lines, curves, and shapes.

V-sync Vertical Synchronization. Also known as the vertical retrace signal. A term referring to the signal that redraws the vertical display of a CRT. How fast this signal is redrawn is referred to as the refresh rate. Usually given in Hertz (Hz), most videocards synchronize buffer swaps with the refresh rate, so framerates under these circumstances will never go past the refresh rate. Some videocards allow buffer swaps to happen without synching to the refresh rate. This will almost always result in faster framerate results, at the expense of visual quality. When a videocard renders without synching to the refresh rate, visual anomalies, such as tearing and shearing of the image, will occur.

W

warm-swappable The ability to add and remove peripherals, such as mice and removable storage drives, without having to power down and reboot.

Y

Yellow Book Specification defining the CD extension that stores data (CD-ROM).

Z

Z-buffer In a 3D videocard, local video memory is often used to form a frame-buffer, which stores all sorts of data required by a 3D card in order to properly render a scene onto your monitor. With the advent of texture-mapped polygons interacting in a 3D world in realtime, the need to have a buffer with which to track positioning became a necessity. A Z-buffer stores the Z-axis value (front to back) of a pixel on-screen—this value is compared with incoming Z-value data to determine whether the pixel will be drawn or not, and how overlapping pixels will be presented. How accurate a Z-buffer is dependent on how the 3D accelerator handles Z-buffer calculations, and how much memory is allocated to it. Higher color-depth rendering requires more Z-buffer memory, as the amount of pixel information is made larger with more color usage. It speeds up 3D gaming by not rendering the parts of a scene that are obscured by other objects.

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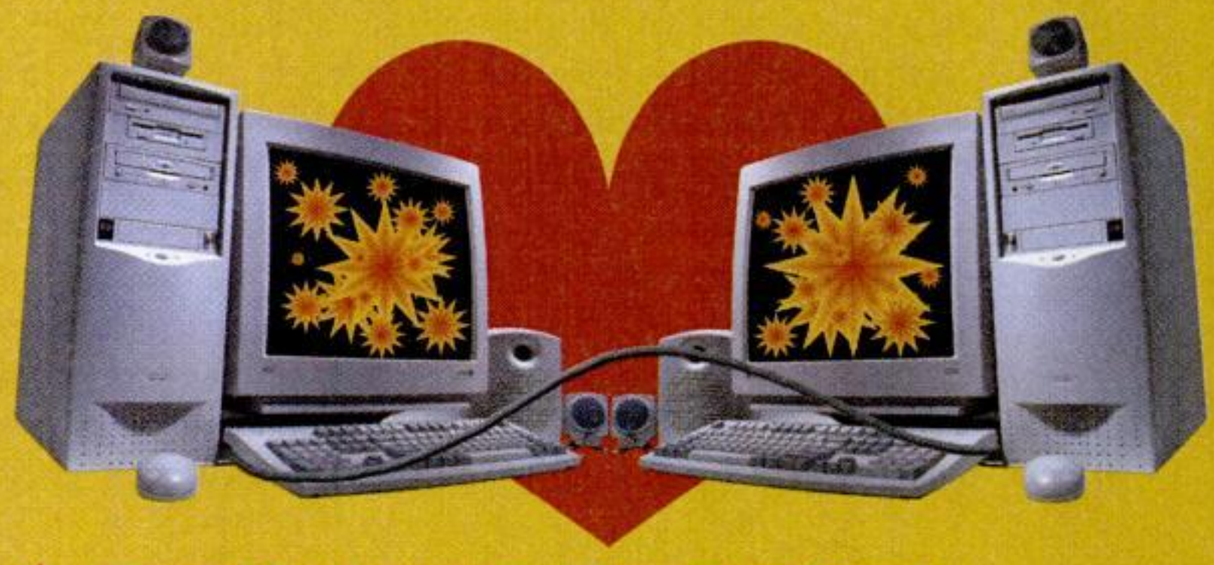

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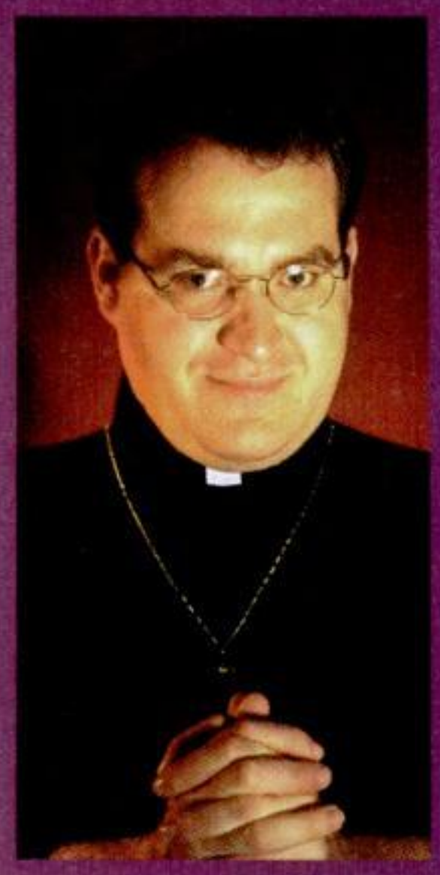

ALEX ST. JOHN
was the architect of DirectX while an evangelist at Microsoft. Since leaving the empire, he has remained a player, brokering many deals in the industry. Reach him at **saint@maximumpcmag.com**.

The Art of Blackmailing Microsoft

IT'S A REAL PROBLEM WHEN THE EMPIRE'S CREATIONS ESCAPE INTO THE FREE MARKET

There was once this guy who worked for Microsoft. He built a little empire for himself making multimedia technology. He was widely regarded as an insufferable bastard, and during a heated battle over control of 3D technology, he was fired. He left Microsoft at the age of 31 with several million dollars.

Those who know my own story may recognize this scenario. But the guy I'm talking about is Rob Glaser. He was in charge of Microsoft's multimedia technology two management generations before the Saint came on the scene. If the name Rob Glaser isn't familiar, you haven't been reading the Wall Street Journal recently, when one headline read: "Former Microsoft Ally Joins The War Against Company".

Nowadays, he's the President of RealNetworks, the company that rose to prominence with RealAudio and RealVideo streaming over the web, and he just testified to the Senate that Microsoft was trying to kill his company. He said it had deliberately crippled his streaming video technology under Windows.

Glaser knew what all of us working on multimedia at Microsoft knew: Bill Gates hated QuickTime. And I don't mean a passing dislike. He lost sleep over it. It drove Bill nuts that Apple controlled the leading video technology on his platform.

Glaser also knew the secret recipe for creating platform leverage. He built an Internet parasite—a business model that would sacrifice its own short-term interests to spread like cancer across the web, and once entrenched could be leveraged for selling other products and services. Conveniently, it involved streaming video—a secret hand signal to Microsoft that said: "I know your trick, and I'm going to use it to hit you where it hurts. I found the way to beat QuickTime on the net, and I'm going to be your next headache!"

There's nothing scarier to Microsoft than when its own people escape with the secret formula and are still either ambitious or poor enough to use it. Gates sent Paul Maritz, Microsoft senior vice president, to negotiate.

The next part of the story is based on rumor and innuendo. It may be wholly false, but my sources are other ex-Microserfs in positions to "know."

The terms of the deal were kept quiet, but internal rumor suggested that it was worth between $60 and $120 million: $30M for 10% of the company, $30M for the current source code—version 4 at the time—and the rest was an option on another 10% of the company and two future generations of RealNetworks.

Then Glaser pulled a fast one on the empire. After taking Microsoft's money for RN4, Glaser immediately shipped RN5, thus rendering the source code purchased by Microsoft obsolete. Paul Maritz, and probably Bill, was furious. There was no way Glaser was going to get another dime from them. So what was Glaser's next move?

The Wall Street Journal reported that "Testifying before the Senate Judiciary Committee, [Glaser] said Microsoft had played dirty by deliberately designing a product to disable his own. He added that he had made a personal appeal to meet with Microsoft Chairman Bill Gates to resolve the problem before the hearing but was coldly rebuffed."

Further on in the article: "The company gave reporters a hastily drafted and notarized statement from Paul Maritz saying Mr. Glaser had offered 'to negotiate all night if that's what it takes' to come to an agreement with Microsoft before the hearing. In exchange for an agreement, Mr. Maritz said, Mr. Glaser offered not to testify before the committee."

Blackmail, anyone? Actually this is a pretty popular tactic for getting a meeting with Microsoft executives. Variations include the "I've partnered with your competitor" press release and the "I'm telling the media I'm thinking of suing you" strategies for getting Microsoft to pay attention to you. You'd be amazed at how much of the news you're fed is generated by Bill's schedule being booked. I saw this approach used a lot while I was at the empire. Remember the Open Letter to Microsoft on OpenGL? It was authored by an ex-Microsoft employee who threatened to publish it if he couldn't get a meeting with Maritz.

If you can't negotiate favorable terms with a big company, you can always rely on grandstanding politicians to provide a public forum for you to take your revenge. It's Techno-McCarthyism.

As many of you might be aware, it didn't work for OpenGL.

What most people don't realize is that this game is going on all the time. If you can't negotiate favorable terms with a big company, you can always rely on grandstanding politicians to provide a public forum for you to take your revenge.

It's Techno-McCarthyism.

Nevertheless, I sleep better at night knowing our government is there to help the downtrodden underdogs of the Internet garner free media, divert attention from their own failures, and eliminate enemies. ✹

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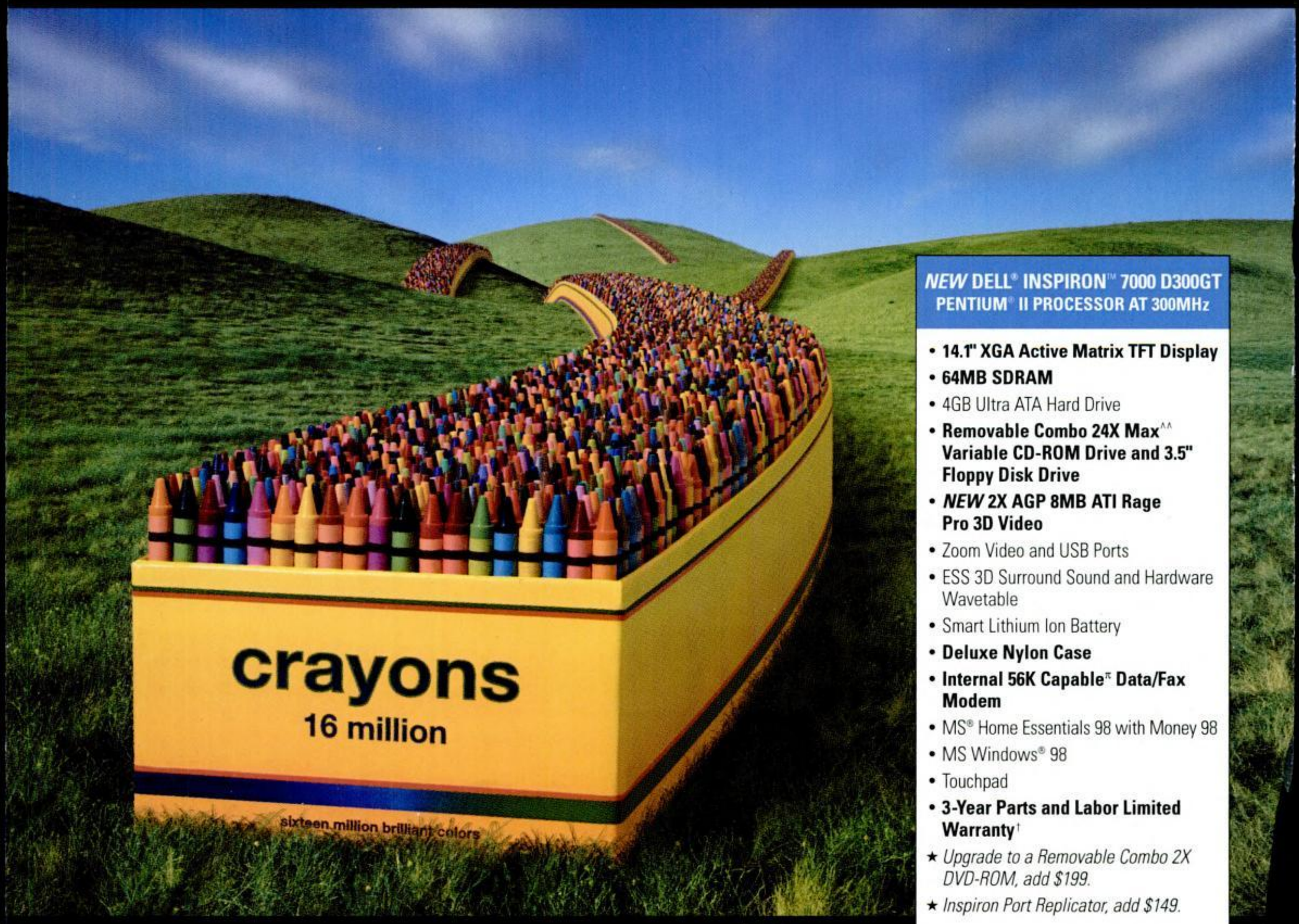

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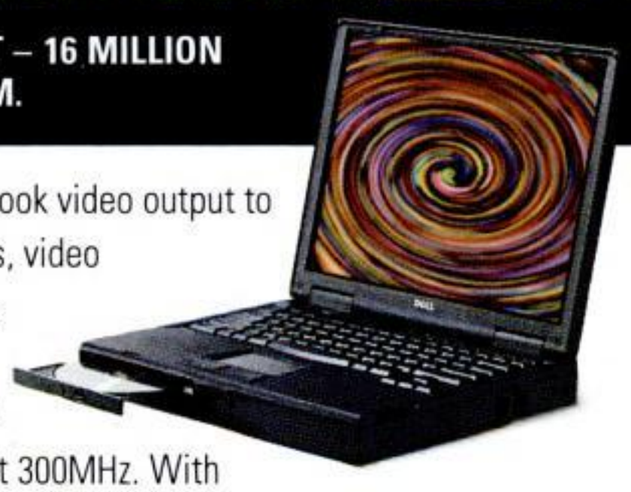

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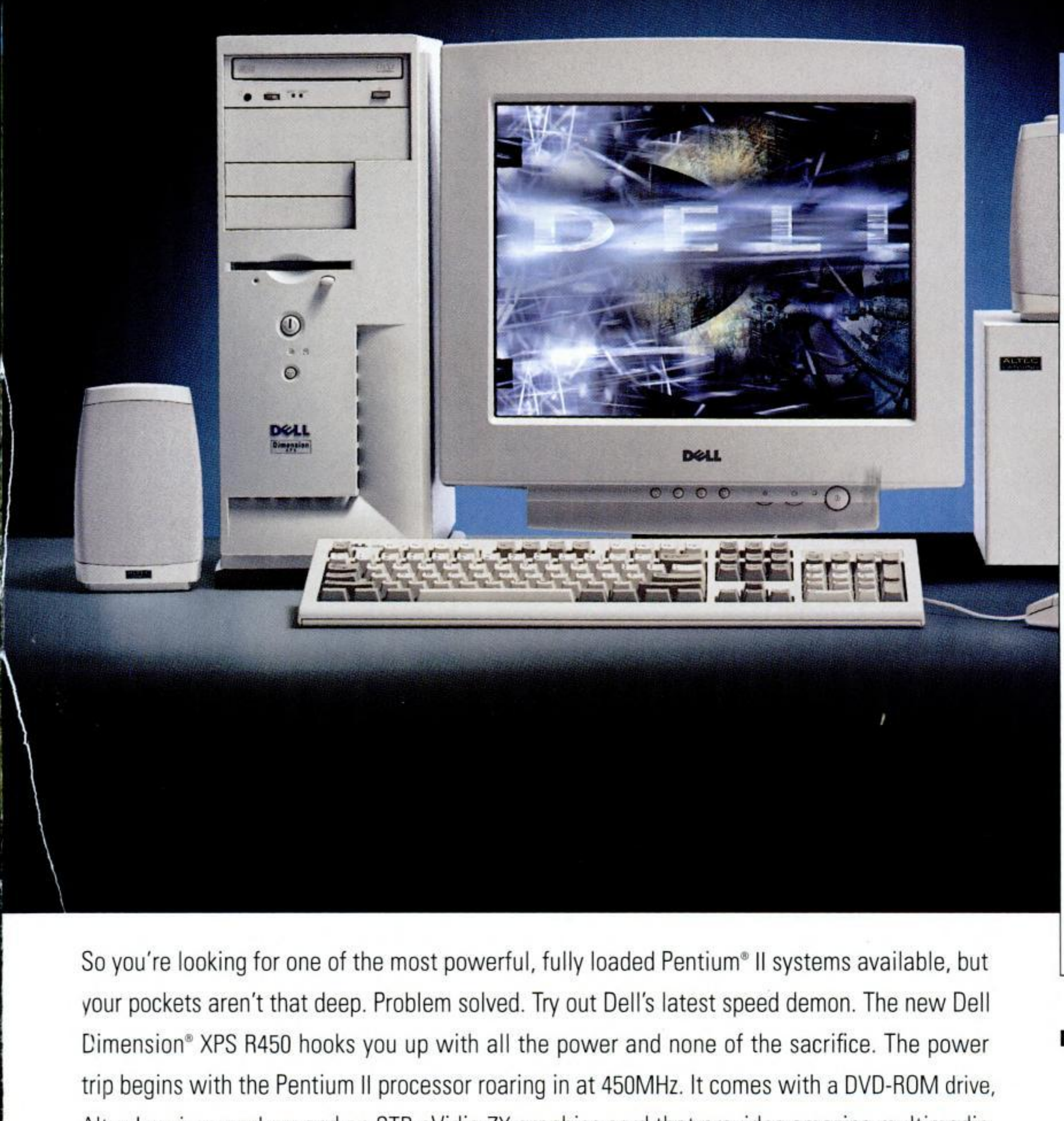

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